JULY 1951

INDUSTRY AND POWER

For Executives and Engineers Responsible For Engineered Plant Services

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Over 100 systems used to move 3,000,000 cfm of conditioned air . . . *page 78*

A STEAM TRAP MECHANISM GOOD FOR 900°F, 950 PSIG

. . . will last a long time on low and medium pressures

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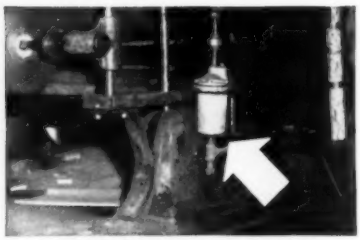
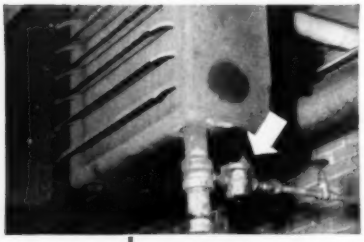
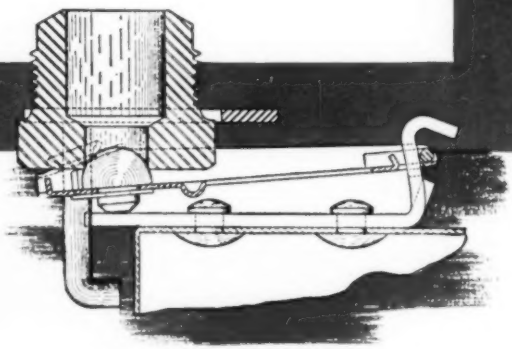


"TRAPS OPERATE 4 TO 5 YEARS WITHOUT REPAIRS." . . . Weymouth Art Leather Co., South Braintree, Mass.



"50% LESS TRAP MAINTENANCE since installing Armstrongs on low pressure vacuum return heating system." . . . John Deere Ottumwa Works, Ottumwa, Iowa.



THE valve and seat in *every* Armstrong Inverted Bucket Steam Trap are chrome steel — hardened, ground and lapped to a steam-tight fit. The valve lever assembly and the bucket are corrosion resistant 18-8 stainless. You get the same design, workmanship and materials whether you order traps for a low pressure heating application or for a high pressure power plant application. *In other words, you get the longest-lasting, most trouble-free trap that money can buy at no premium in price.* If you think you'd like that, call your nearby Armstrong Representative for the traps you need now.

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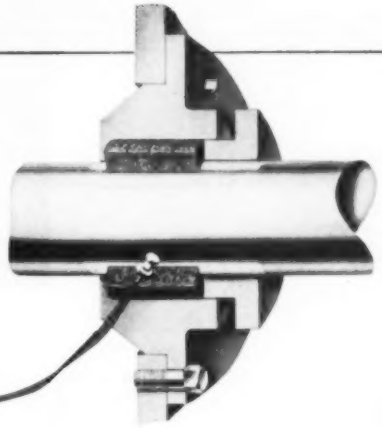
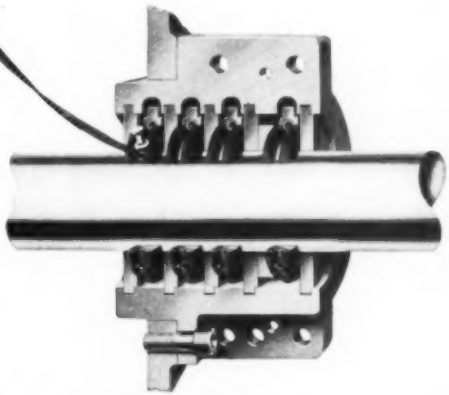
offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

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When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

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COPPUS ENGINEERING CORPORATION
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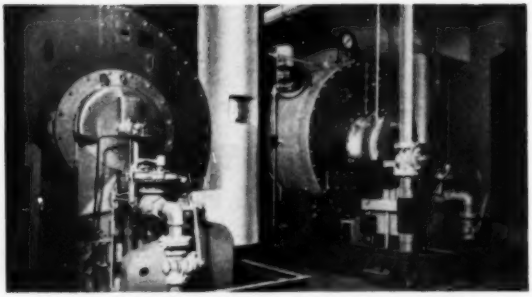
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

"The Boiler-Room? — On the Roof, Sir"



The "First of Tulsa" Boiler Room — Two Cleaver-Brooks 200 hp. Gas Fired Boilers

Boiler-Room in the SKY..

Boiler Room Directly Behind Roof Sign

FIRST NATIONAL BANK OF TULSA
TULSA, OKLAHOMA

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FURTHER PROOF OF CLEAVER-BROOKS BOILER FLEXIBILITY

The new $6,000,000 First National Bank of Tulsa, one of the finest buildings in the Southwest, is heated with Cleaver-Brooks Self-Contained Steam Boilers.

For very good reasons the boiler-room was placed at roof level. (Boiler-room is directly behind roof sign at top of building, instead of conventional location in basement.) First, since it was a bank building, basement space was extremely valuable for vaults, storage, and air conditioning equipment. Then, too, with the fresh air intake on the top of the building, a considerable amount of piping was eliminated by placing the boilers at the same point. Since Cleaver-Brooks boilers require only a simple vent for carrying off combustion gases, long stack runs were eliminated, leaving additional valuable space within the building.

These are just a few of the many reasons why Cleaver-Brooks boilers were specified. Being completely self-contained and compact in design, requiring minimum head room and floor area, Cleaver-Brooks boilers presented no installation problem.

Cleaver-Brooks Self-Contained Boilers are available for oil, gas, combination oil and gas firing, 15 to 500 hp, 15 to 250 p.s.i., for heating and processing loads. Write for the catalog.

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INDUSTRY AND POWER

The Magazine for Engineered Plant Services

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Cover Illustration

Ten Cooper-Bessemer Type GMW V-angle gas engine compressor units producing 15,000 hp installed at El Paso Natural Gas Company's main line compressor station near Kermit, Texas. More details on these engines will be found on page 91.

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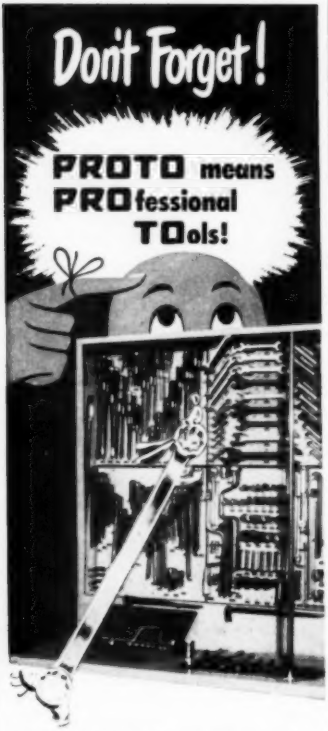

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Acorns of Science

Developments not yet available, but of interest to those who are responsible for The Engineered Plant Services

Two Minute X-Ray Pictures

● Another application for electrostatic images, under joint development by The Haloid Co., Battelle Institute and G. E. X-Ray Corp., xeroradiography ("x" has "z" sound) is a fast direct-positive, low cost process for producing x-ray pictures. With x-ray inspection of metals faster and more economical, it should find wider application. Plates are reusable, require no chemicals and are unaffected by most types of radiation.

Lubricants Under Pressure

● For the first time, effectiveness of lubricants under pressures up to 250,000 psi can be measured accurately. A testing instrument, developed by Socony-Vacuum Laboratories, uses two, ¼ in. steel cylinders at right angles. One rotates against the other under measured force and torque. Lubricant effectiveness is determined by microscopic examination of wear at contact point. Shear strength is also found. In addition to fluids, solids such as soaps can be tested.

Magnesium Gets Protection

● Developed at Frankford Arsenal, HAE coating is applied electrolytically. It is hard enough to scratch glass, has good dielectric strength, is a good paint base and resists corrosion, galvanic action and abrasion. After waxing, coating withstood 4,500 hr of salt spray without corrosion. Melting point is high, base metal in heat tested panels flowed away leaving coating unchanged.

For Speed Variations

● A tachometer that records sudden speed changes has been developed at Eastman Kodak Co. and described at AIEE summer meeting. A frequency signal, generated by the sensing unit, is amplified and converted to d-c. A bucking circuit cancels average speed voltage, leaving only variations which are further amplified and recorded on a direct inking oscillograph sensitive to 100 c. Variations in gear and belt drives and torque pulsations caused by dead armature coils were measured.

Concentrated Pull

● Alnico has been bettered as a permanent magnet material for small size units by a cobalt-platinum alloy developed at General Electric Research Laboratory. Because of better coercive force and retentivity, a magnet of the new alloy about the size of a pencil eraser lifted 24 times as much as an equal sized Alnico magnet and had eight times the resistance to demagnetization. Cost of platinum, scarcity of cobalt and inefficiency in larger sizes may limit use to special applications.

Slow Motion Burst

● Called a non-explosive, chemico-mechanical device, it breaks coal from the mine face by force of compressed gasses released from a chemical reaction contained in a tube with a relief disc. Under development by Du Pont Co., the unit is placed in holes drilled in coal face. The reaction, initiated by electric current in a starter wire, generates high-pressure gas that ruptures disc, escapes and breaks down coal. Slower expansion produces a maximum of coarse coal with safety and efficiency. There is no flame, no danger of starting by stray currents or even dynamite blasts. Sounds like a promising new type of self-contained pressure generator.

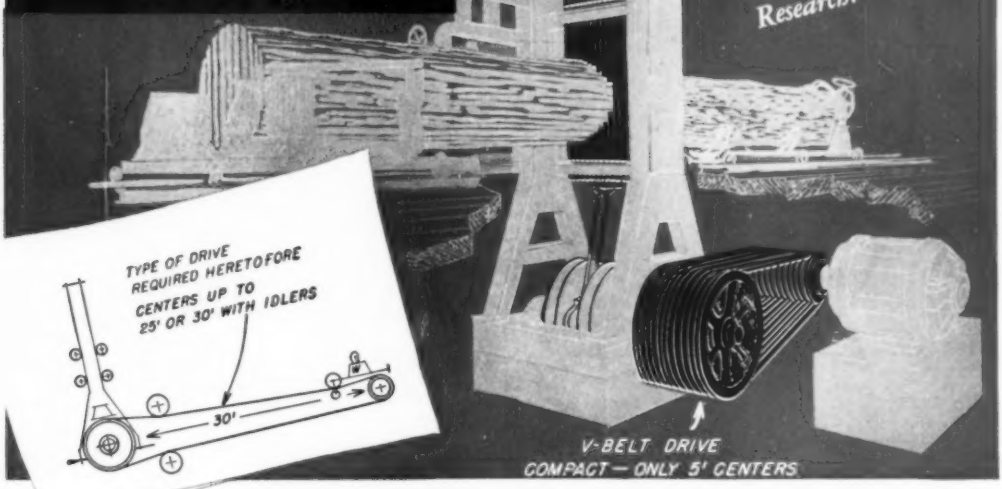
Metal to Glass Soldering

● Metals and glass (also other ceramics and carbon) can be soldered to each other by painting both parts of joint with titanium hydride, applying solder and heating assembly under vacuum. At 900 F, hydride decomposes and the already molten solder wets both surfaces. Cooled joint is stronger than glass. Soft solders absorb expansion differences during temperature changes. Process was developed at General Electric Laboratories.

The first successful V-Belt Drive for GANGSAWS

Designed by
Gates Engineers

Another practical application of Gates Specialized Research!



A large maker of gangsaws said to Gates Engineers, "If you can design a V-Belt drive to handle the *fluctuating load* on a gangsaw, we can discard the long and troublesome flat belt that we have always thought we had to use."

The *reasons* for his statement are quickly told:—

A gangsaw (or Swedish type Gang Mill) consists essentially of several saw blades mounted in a heavy steel frame or "sash" that moves rapidly up and down like a monster jig saw. This sash may weigh a ton or more—yet it makes about *five* 24-inch *up* and *down strokes per second!*

On the *up* strokes, the saws have no cutting load on them. But on the *down* strokes they must often slash a log up to 36" diameter into 2" planks. This great unbalance in load between the *up* and the *down* strokes has heretofore defeated all efforts to apply a V-Belt Drive to saws of this type.

After thoroughly analysing the fluctuating load on gangsaws, Gates Engineers recommended very minor changes in design which would permit the application of V-Belts and—what is of *utmost importance to you*—they were able to write down *in advance* the exact specifications of the V-Belt Drive that has very successfully handled this extremely difficult assignment.

This *pre-solution* of drive design problems is possible because Gates operates the largest V-Belt testing Laboratories in the World—and Laboratory findings are carefully checked by tests made under actual field conditions. Finally, the *results* of these exhaustive tests are immediately reduced to *usable data* for the design of V-Belt drives to *perform whatever task may be required.*

Phone a Gates Field Engineer

If you have a difficult drive to design, or if some drive in your plant is giving trouble, or if you only want to be sure what size and construction of V-Belts will give the most efficient and the lowest cost service on any particular drive—you have only to phone a Gates Field Engineer, *always near you* in all industrial centers.

Just look in your phone book under "Gates Rubber." A Gates Field Engineer will come right to your plant and put at your service the full benefits of Gates V-Belt knowledge and experience *without the slightest obligation!*

ENG. 515

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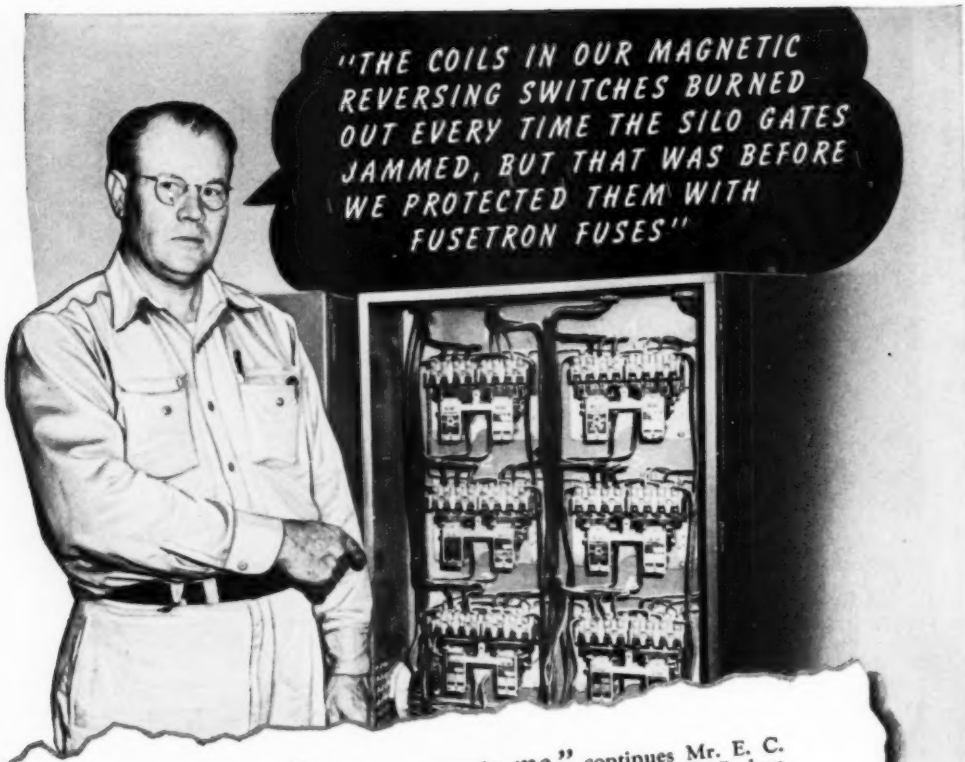
"THE COILS IN OUR MAGNETIC REVERSING SWITCHES BURNED OUT EVERY TIME THE SILO GATES JAMMED, BUT THAT WAS BEFORE WE PROTECTED THEM WITH FUSETRON FUSES"

"Sure! *you can quote me,*" continues Mr. E. C. Willy, Chief Electrician, H. J. Kaiser Co., Radum Plant, Pleasanton, Calif.

"In the past, we found magnetic reversing switches welded the main contacts when Silo Gates jammed. When reverse control operated, the armature could not properly engage, resulting in a burned out coil.

"The coils cost about $4.00 each, but most important was the substantial production loss each time the coil burned out.

"We now have 4/10 ampere Fusetron dual-element fuses installed to protect these coils. During the year 1950 we blew about 100 Fusetron fuses, but didn't lose any coils. This represents a saving of at least $400.00 in coils and kept me from being dragged out of bed at night, an occurrence that often happened before. Then, too, we can replace burned out Fusetron fuses much faster than we can replace coils, to say nothing of the valuable production time we save."

Facts about Fusetron *dual-element* Fuses

- The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.
- They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.
- Made to the same dimensions as ordinary fuses — fit all standard fuse holders.
- Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.
- Their cost is surprisingly low.

FUSETRON

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2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

★ Fusetron Fuses have high interrupting capacity as shown by tests of Electrical Testing Laboratories of New York City in December 1947.

Don't Risk Losses!

One **destroyed** switch or panel . . .
One **needless** shutdown . . .
One **lost** motor . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

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St. Louis 7, Mo. (Division McGraw Electric Co.)

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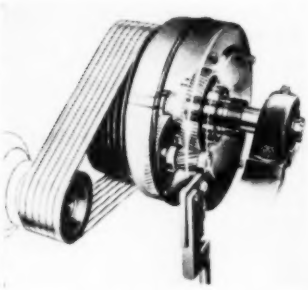
new equipment and developments

You can easily get more data on these new equipment and development items. Use the handy, postage-free order cards on Page 123. Just list the key numbers of the descriptive paragraphs in the space provided on the card and mail

1—REDUCTION DRIVE OVERLOAD RELEASE

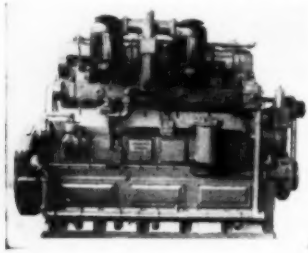
The American Pulley Co. announces the availability of a simple, fool-proof, mechanical overload release for use with the complete range of sizes of their reduction drive. This overload release is used on the reducer end of the torque arm and is



so constructed as to engage the housing stud of the unit. The mechanism is pre-set for the maximum torque. It works equally well, whether the torque arm is mounted so as to be in tension or compression and provides instantaneous release of the unit upon any excessive jamming or shock loads, thus protecting both the motor and the machinery against damage.

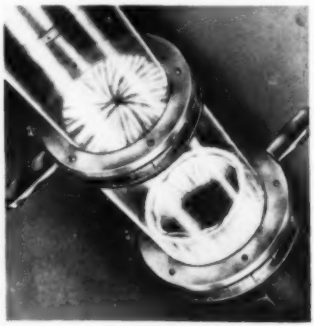
2—NATURAL GAS OPERATED ENGINE

Natural gas, where available, can be utilized in a new engine developed by Cummins Engine Company, Inc., that is classified in the medium speed field, because of its 1100 rpm rating. The I.R-600-GAS is a 6 cylinder, spark ignition engine, with a displacement of 2477 cu in., a bore and stroke of 7-1/4 by 10, and a maximum rated horsepower of 315. It is equipped with a gas carburetor, mixing valve, magneto and special accessories for gas operation. Approximate weight of the engine is 7500 lb, and it has a compression ratio of 6.8 to 1. One of the standard items is air starting equipment. A 32 v electric starting system is optional. Two oil bath air cleaners are provided, as well as a mechanical flyball type governor and a water cooled exhaust manifold.



3—VALVE CONTROLS BULK FLOW

A new type of valve for controlling the flow of bulk materials from bins, hoppers and chutes in weighing, blending and packaging operations—and for free air control in heating, ventilating and drying —is now available from Syntron Co. This flow control valve has a flexible diaphragm (made of cotton duck, nylon, rubber or other material suitable to the application)



which, in operation, is similar to the iris device of a camera. Rotating the control lever increases or decreases the opening of the diaphragm and the flow of material. The material passed through the valve does not come into contact with any moving metal parts, thereby eliminating possible jamming and clogging in reducing the flow of material or in stopping it altogether. It can be readily attached to bin and hopper discharge openings—to supply chutes and ducts—and in air ducts. The fabric diaphragm will withstand many months of hard usage and may be replaced at low cost. Available in 5 different sizes to fit various diameter openings up to 12 in.

4—UNIT DEVELOPS 200 PSI IN TWO MIN

Vapor Heating Corp. has announced the production of a packaged steam generator to supply high pressure steam for plant processing and other uses. This machine develops over 200 psi steam in two min. from 50 F feed water and produces over 4500 lb of steam per hr at between 75 and 600 psi. The steel coil is 702 ft long. The combustion chamber is in the center, and the atomized diesel oil fire burns at almost 3000 F — releasing a million Btu's

per cu ft of space with a thermal efficiency of 82 per cent. Ten gal of water, pumped through the coils, is turned into high pressure steam per min., when full on. Automatic control in the cabinet modulates output from one-third to full capacity, turns the machine on and off and generates steam only when required. The steam pressure may be changed by a one control operation. A 7½ hp electrical motor or gasoline engine operates the water pump, forced-draft blower, fuel pump and ignition. An electric eye has been incorporated to assure the utmost in safe operation and control combustion, steam temperature, limit control, exhaust temperature cutout, time delay relays in initial starting and safety valve.

5—DEVICE CLEANS IMPACTED TUBES

A fast and economical straight tube cleaner developed for process and refinery heat exchangers has been announced by Thomas C. Wilson, Inc. This device,

designated as Model TP-301 will remove deposits from completely plugged heat ex-

(Continued on page 12)

ANOTHER NOTABLE ACHIEVEMENT IN SERVICE LITERATURE BY JENKINS

THE NEW

BOOK No. 2

Nos. 26—50

practical piping layouts

The second series of twenty-five basic Piping Layouts (published by Jenkins Bros. in leading industrial, professional, and engineering publications) is now available in booklet form.

If you are among the hundreds of valve-users who received a copy of the first book, or if you saved any of the fifty Jenkins Piping Layouts as they appeared, then you know how helpful this information can be in planning any valve installations.

This new book brings you not only 25 practical piping layouts, arranged in convenient form for quick reference. It also includes a section on the fundamentals of valve design and application to help you select the type of valves best suited for the service.

Use it as a guide to proper valve selection and placement for longest service life and lowest operating costs. Use it also for an introduction to the wide range of Jenkins Valves for every industrial engineering and plumbing-heating service. You can obtain a copy by requesting it on your business letterhead. Address:

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JENKINS VALVES

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SINCE 1864

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THIS SECTION DOUBLES ITS VALUE TO YOU!

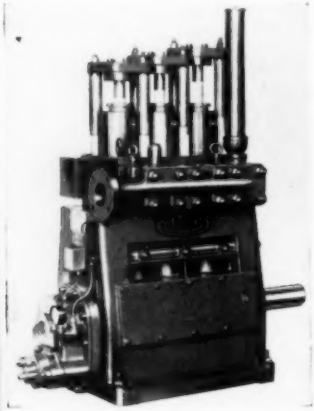
Tells "Which valve where, and why"—with information in chart form for quick reference. A compact manual that will be prized by everyone, beginner and veteran alike, who plans piping.

(Continued from page 10)

changer tubes, according to the manufacturer. This new tube cleaner weighs only 15 lb and is only 13 in. in length. Adaptable for 3/8 up to 2-1/2 or even 3 in. OD tubes. Hollow shafting is available in one piece up to 20 ft or in sectional threaded lengths, if desired. Minimum practical working headroom is 5 ft. This positive air driven, rotary shaft, drill type tool scavenges the tube with air or water while cleaning. It operates on air pressure as low as 50 psi.

6—PRESSURE PUMP HAS STRAIGHT LINE FLOW

Aldrich Pump Co. announces the addition of a 3 in. stroke triplex, direct flow pump to their over-all line. This unit can operate at speeds up to 500 rpm — an increase over previous models, resulting in more work from a lighter, more compact pump. Power ranges up to 50 hp, pressures up to 3800 psi and displacement up to



96 gpm at 790 psi, 500 rpm. The unit passes liquid in a straight line directly through the working barrel. Two right angle turns were eliminated in the fluid-end block that resulted in a reduction of "loss space" in the fluid end. Volumetric efficiency was improved along with a saving in material. The fluid-end is sectionalized in construction so that maintenance is simplified and inexpensive. Change in plunger size can be readily made to meet alterations in pressure or capacity.

7—ELECTRIC PLUG HAS SPRING ACTION

Good contact in worn receptacles is assured by the double spring-type blades of a plug now being offered to electrical cord set and electrical equipment manufacturers for original equipment and as replacement by Laminated Metals Products Corp. These plugs, manufactured by Waldron

Products, have "bowed out" blades in both direction to insure connection, regardless of where contact is located in the receptacle. Flexibility of the blades prevents the plug dropping out of loose receptacles. They have been approved by Underwriters Laboratories for use on electrical cords in making a connection using up to 15 amp at 120 v or 10 amp at 220 v. UL also permitted the blade halves to remain spread apart to within 1/4 in. from the outer end because of the flexibility of the hinged joint at the end of the blades. Good electrical connection is thus assured as most receptacles have their contacts at this point.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

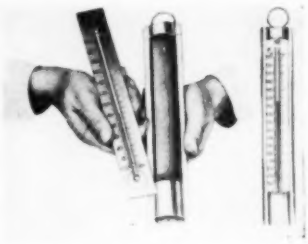
8—VALVE PREVENTS LINE SHOCK

Surge damping valves said to eliminate excessive shock in high pressure hydraulic systems have been developed by The Denison Engineering Co. Small and compactly

designed, they are installed as easily as any ordinary fitting and do not interfere with other functions of the circuit. The valve prevents shock from occuring, rather than simply hydraulic surge and consequent shock. Applications for this surge damping valve are: installation at the ports of 4-way valves, in a cylinder circuit as an automatic decompression valve and in any line leading from an accumulator. The valve adjusts itself automatically to any working pressure, requires only a fraction of a second to act and cannot slow down cycle time. A normally closed valve, it gradually opens when pressure is applied to the inlet side. When the flow is interrupted, the valve quickly resets and is ready for the next operation. It requires no manual adjustments and has no external drain.

9—THERMOMETER HAS REPLACEABLE SCALE

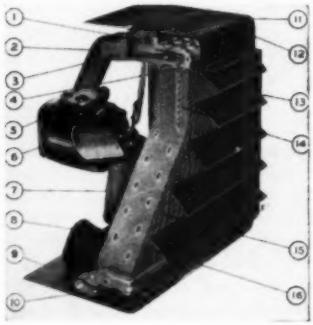
A thermometer featuring a stainless steel case, that is stronger, more rigid and longer lasting than conventional types and designated as TAG Model 8689, is now available from Tagliabue Instruments Div., Weston Electrical Instrument Corp. With a "no-waste", functional design incorporating heavy, corrosion-resistant stainless sheet steel, the all-purpose instrument is suited for use wherever an accurate, dependable thermometer is needed regardless of weather or other conditions. The scale of model 8689 is large, clear and easy to read and can be obtained in five different types ranging from —40 to as high as 400 F. The arched "bows" and flanged edges of the case provide the greatest possible angle of vision commensurate with the best protection to the glass tube. Wide open



spaces around the bulb ensure maximum air circulation for true value readings. A special feature of the new thermometer is the removable scale and tube unit for easy replacement in the event the tube should get broken.

10—COOLING UNIT HAS DUAL APPLICATION

Young Radiator Co. has announced nine models of unit oil coolers of practical application where water is at a premium or waste heat can be recovered to warm interiors. Some of the design and construction features of the non-ferrous tube and fin unit are: large full size supply and return tappings, close grain cast iron one



piece construction in supply and return headers, large round tubes expanded into headers with ferrules, all welded construction, ribbed and braced for strength, spring mounting and cooling element to permit expansion and contraction, air deflection louvers designed for strength and efficiency, patented agitator breaks up oil flow, increases heat transfer 100 per cent, fins are mechanically bonded to tubes and the unit is guaranteed for 150 psi oil pressure.

11—TACHOMETER HAS WIDE SPEED RANGE

Metron Instrument Co. has made available a three range, single head, fixed installation tachometer indicator for applications where a particularly wide range of speed measurement is desired. This instrument, Series 42P, can be used with any series Metron tachometer head. Simple rotation of the indicator range knob instantly selects one of three speed ranges to measure any speed over a total range of 40 or

(Continued on page 14)

Prevent Return Line Corrosion

with

FILMING AMINES*

HERE'S AN exciting new development in the Water Conditioning Field!

Corrosion of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new, advanced process for the prevention of return line corrosion employing *octadecylamine*. This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surfaces in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment. Results? As high as *99 percent reduction* in corrosion rate has been achieved!

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal I.

Send for Betz Technical Paper #121, "How Filming Amines Prevent Steam and Return Line Corrosion".

*U.S. PATENT 2,460,259

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

(Continued from page 12)

50 to 1, based on readings down to 1/10 full scale of the lowest range. The ranges are carefully chosen for ease in reading, and the scales are all a full 4 in. long with 100 divisions. Indicator calibration is stable indefinitely and good over a wide temperature range. Calibration is easily ad-

justable in the field. Scales are supplied for direct reading in any units such as rpm, fpm, in. per sec or in any quantity, which is proportional to the speed actuating the head. Various tachometer heads permit direct measurement ranges from speeds between 1/2 and 100,000 rpm.

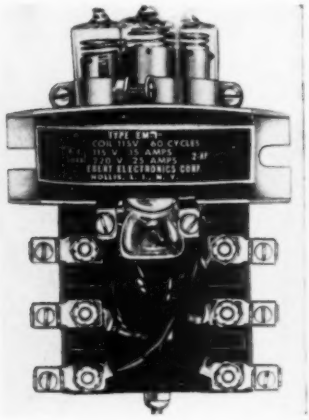
12—LIQUID BLENDER IS AUTOMATIC

An automatic proportioning system for blending two or more of a wide variety of liquids has been developed by Bowser, Inc. No charts or calculations are used to set the blender for any combination of liquids. Simple controls on each meter per-

mit instantaneous setting of ingredient proportions in increments to meet customers' exacting needs. All measurement is by accurate, positive volumetric displacement and any number of ingredients may be blended. If the number of ingredients is reduced at any time, one or more meters may be made inoperative. Dials and gages are all visible from the outside of a cabinet, which encloses the entire blender. It is dust-resistant and can also be equipped for operation in corrosive atmospheres.

13—RELAY HAS MERCURY ELEMENT

Ebert Electronics Co. announce a new version of their hermetically sealed mercury contact plunger relays. This device, Type Em-7, is a three pole relay employing one coil. Tungsten contacts are hermetically sealed in hydrogen-filled glass tubes. Three standard Ebert Type EMT tubes are used



in one coil structure. This construction provides a reliable and positive simultaneous contacting means for loads up to 35 amp at 115 a-c or 25 amp at 220 a-c per contact. They can be supplied with all three contacts either normally open or normally closed or with any combination of normally open and normally closed contacts. Because of the unique hermetic structure and mercury-to-mercury contact, test relays have withstood over 10,000,000 operations without failure. Outline dimensions are 4-1/16 in. wide, 5-3/8 in. high by 3 in. deep.

14—PILOT HAS WIDE VOLTAGE RANGE

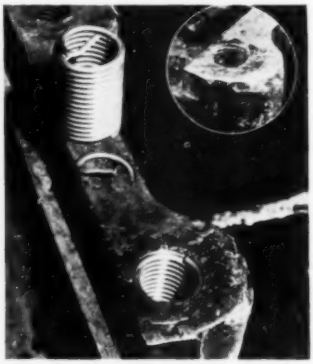
An improved low cost pilot light known as the Omni-Glow Model 1010 is announced by Industrial Devices, Inc. It is a neon light encased in a nylon tube that slips through the mounting panel and is held in place with a special speed nut sup-

plied with the unit. The lens is available in a wide selection of colors suitable to neon and features Fresnel lens for more even distribution of light. A polished metal collar, connecting lens and body, provide attractive trim on the operating side of the panel. Operating on a voltage range of from 75 to 250 v, a-c or d-c, it provides a pleasing, soft light with practically no heat. The neon light withstands vibration and shock, as well as voltage overloads.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

15—DEVICE SPEEDS THREAD REPAIRS

Stainless steel helical-wire thread inserts for speeding thread-repair operations on heavy electric motor castings are announced by Heli-Coil Corp. These threads, stronger and more wear-resistant than original



threads, are installed in 80 per cent less time than conventional repair methods require. Installation consists of: (a) drilling out the old threads, (b) retapping with a Heli-Coil tap and (c) installing a stainless steel thread insert with an inserting tool to bring the hole back to original threaded size. These thread liners resist abrasion and eliminate seizing, galling and corrosion. The unmounted thread insert, with a free diameter slightly larger than the receiving hole, is self-locking when positioned in the hole, yet may be removed with another tool.

16—OVERLOAD INDICATOR FOR TRANSFORMERS

Allis-Chalmers Mfg. Company's distribution transformers are now available with a new overload indicator operated by a thermostatic element in the top oil. This device operates purely as a signal warning and does not interrupt the continuity of service to a customer in any way. An overload indicator thermostatic element is designed to trip 80C top oil temperature. This corresponds to 50C maximum top oil rise above 30C average ambient temperature. When the oil reaches the predetermined temperature, a signal light snaps on and stays on until turned off by the utility serviceman. This is done by moving the handle indicator in a clockwise direction until the pointer is on the reset mark. The handle is then returned, counter clockwise, to its original close position. The indicator

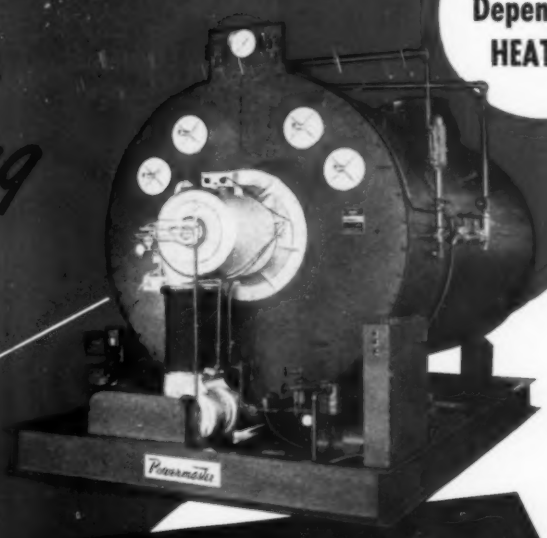
(Continued on page 16)

HERE'S THE **MODERN** WAY to

Reduce Operating Costs!

For Dependable HEATING

For Efficient PROCESSING



O & S *Powermaster*

● 15 to 500 HP. steam generating units from 15 to 200 p.s.i. and hot water boiler units—for light oil, heavy oil, gas and combination gas/oil firing.

- Delivered completely wired and factory-tested
- Mounted on steel base — no bricking required
- Automatic operation frees engineer for other duties
- Constructed to A. S. M. E. standards
- Approved by Underwriters' Laboratories
- Prompt service by factory-trained men

● With your operating costs growing higher than ever, isn't this a mighty good time to take a look at your boiler room? That's where efficient, cost-saving plant operation should start.

Maybe your boiler is eating fuel dollars. Perhaps it's inadequate to meet your greater steam demands. Chances are it's obsolete at today's standards. You may find it possible to cut costs enough to actually pay for a new O&S *Powermaster* unit in two or three years. Many *Powermaster* users tell us they *have!*

It makes sense to turn to this up-to-date self-contained unit for either process steam or heating. All Powermaster components are sized to coordinate most efficiently as a fully automatic packaged unit. You'll reduce operating costs (as much as 40%) and cut maintenance time to a minimum. You'll be sure of safe, smokefree, dependable operation.

Write today for complete information on a Powermaster unit for your specific needs. Or send coupon for latest bulletin describing all units.

Powermaster®

STEAM GENERATORS AND HOT WATER BOILER UNITS

Orr & Sembower, Inc.
950 Morgantown Rd., Reading, Pa.

Please mail latest catalog showing Powermaster's cost-cutting advantages.

Name_____

Company_____

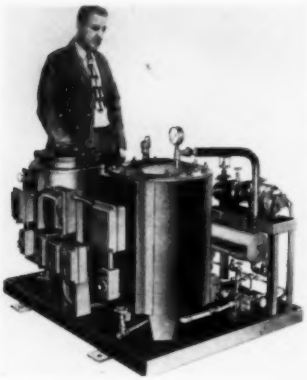
Address_____

(Continued from page 14)

is an economical, maintenance-free signal device and is recommended for systems where more complicated equipment would not be justified. Where records indicate repetitions of overloads, it singles out the units that should be replaced by larger rated transformers.

17—OIL UNIT CONTAINS FILTER AND VAPORIZER

A 25-40 gph oil conditioner unit, specifically designed for small-batch clarification of used hydraulic, lubricating, run-in and transformer oils, has been placed in production by the Filtration Div. of the U. S. Hoffman Machinery Corp. Both in-



soluble and soluble impurities are reported to be completely removed by the unit, which combines a cartridge filter and a vaporizer. Advantages include simplicity, convenience and economy in purifying turbine, circuit breaker, transformer, vacuum pump, cable, compressor, hydraulic and refrigeration oils to "like new" condition. Avoidance of high maintenance costs, such as occur with centrifuges, is stressed. The cartridge filter and vaporizer are mounted on a common base and are complete with all necessary electrical and pump connections. Filter and vaporizer may be operated singly.

18—ROTARY GEAR PUMP FOR HIGH PRESSURE

The John S. Barnes Corp. Constant-flo rotary gear pump is now available in new high-pressure models featuring substantial

improvements in efficiency and performance. These new models have exactly the same overall and mounting dimensions as the standard low-pressure designs. Standard pumps are specified for operating up to 1000 psi continuous and 1500 psi intermittent duty. Special types for still higher pressures have also been produced.

19—MAGNETIC PROTECTION FOR CIRCUIT BREAKER

Circuit protector with a capacity of twelve circuits featuring fully magnetic action in each breaker is announced by Murray Mfg. Corp. Magnetic action makes it impossible for the breakers to trip due to external or internal heat. Standard package of the "12" circuit protector consists of four 14 amp breakers plus two 20 amp breakers with provision for six additional breakers. Six pairs of handle extensions are supplied. No main switch is required ahead of the "12" and "8" circuit protectors, providing the number of operating

handles is limited to six by use of handle extensions. Individual breakers are interchangeable with other new single pole individually housed breakers.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

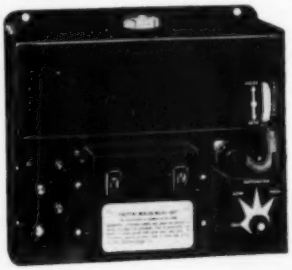
20—PROCESS FOR RUST-PROOFING

Phosphate coating material, developed by Detrex Corp. and recommended as a replacement for cadmium or zinc in many rust-proofing applications, has superior corrosion resistance. When immersed in a solution of the material, iron and steel surfaces are chemically converted into a dark gray, uniform, dense, non-metallic phosphate coating. After rinsing, the highly absorbent coating is impregnated with a rust-proofing oil known as Perm-Oil giving the product a permanent corrosion proof layer that is dry to the touch. Standard salt spray tests indicate a resistance well in excess of the 36 hr required in US Army Specification 57—2c, Type II Class B.

Typical applications are: metal fasteners, springs, hardware and hand tools, appliances, sheet metal parts, clips and links. Long in supply and low in cost, the new process is of particular interest at this time.

21—STEAM CONTROL FOR ALL FIRING TYPES

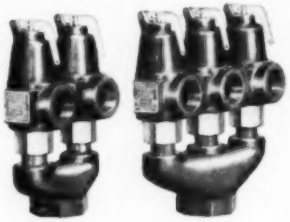
The Cleveland Fuel Equipment Co. steam control can be successfully applied to hold steam pressure at a certain prescribed level. Application is ideal where constant pressure must be maintained despite varying load demands. This model is designed to give accurate, automatic regulation of steam pressure on any type of stoker, gas or oil-fired boiler. It is a compact regulator, to be installed in conjunction with the Cleveland Lectricarm drive unit. It pro-



vides automatic modulation of fuel and air supply in direct proportion to pressure changes and is highly effective in cutting fuel costs on stoker-fired heating boilers, where intermittent operation causes excessive smoking during off-periods. The unit consists of bellows, floating contacts, compensating motor and a pressure adjusting mechanism. Standard units are available for either 110 or 220 v, 60 cycle current. Units are available for wide selection of pressure range requirements.

22—RELIEF VALVES FOR LARGE BOILERS

Assemblies, consisting of two or three safety relief valves, have been developed by McDonnell & Miller, Inc., for adequate-

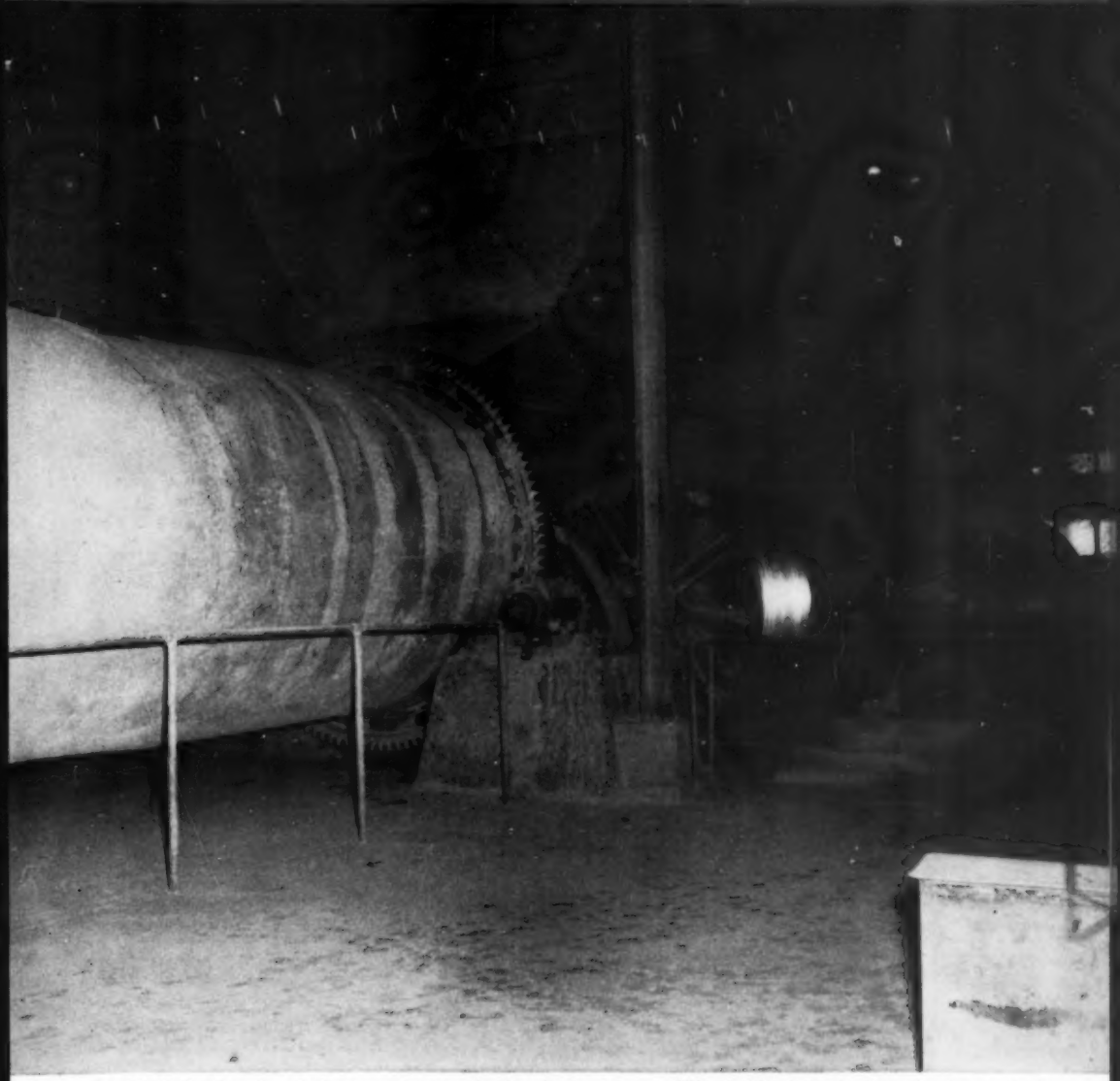


No. 233 No. 333

ly safe-guarding larger hot water heating boilers from excessive pressure. This valve, designated as McDonnell No. 33, has a gross heat output up to 242,900 Btu per hr. The assemblies give a discharge capacity equal to the sum of the capacities of the two or three valves: No. 233 two-valve assembly, total discharge capacity 496,700 Btu per hr and No. 333 three-valve assembly, total discharge capacity 769,400 Btu per hr. When the boiler pressure reaches 30 psi only one valve opens, and then only enough to take care of normal thermal expansion. If, however, a "runaway" firing condition occurs, causing a steaming and

(Continued on page 21)

B.F.Goodrich **GROMMET BELTS AT WORK**



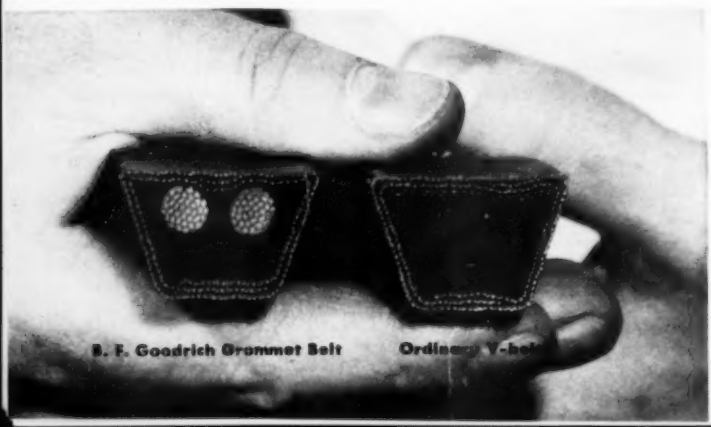
Steel balls inside tube grind gypsum into powder for plaster, just as pebbles inside chicken's gizzard pulverize food.

Steel gizzard makes plaster

This tube, loaded with steel balls and gypsum weighs almost 100 tons. When the tube revolves it does a beautiful job of grinding the gypsum into powder for plaster, but *keeping* it revolving was a major job. It is driven by V belts. Trying to get the weight turning sometimes snapped these belts like so many pieces of string. Belts wore out before their time. An entirely new kind of belt was needed. To find out how the problem was solved, see the following pages.

Steel gizzard (continued)

Power drain of motor here is so heavy, machine is run only at night as belts whirl tube shown on preceding page.



THE only thing the plant manager had to do to solve the problem described on preceding page was switch from ordinary V belts to B. F. Goodrich grommet belts. These belts *look* the same but, because of an entirely different construction principle, grommet belts stand more shocks and heavier loads than any other kind. The B. F. Goodrich belts had been installed five years when these pictures were taken and still look good for many years more.

20 to 50% Longer Life

Patented grommet belts by B. F. Goodrich represent the only basic change

since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a Grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent Number 2,233,294).

Rock breakers ▸

Belts on rock crushers at the Walt Keeler Co., Wichita, Kan., get sudden shock loads. Ordinary belts here failed frequently, wore out fast. A local B. F. Goodrich distributor installed B. F. Goodrich grommet belts. After three years there had been no shutdowns whatever for belt maintenance.

Inside ordinary V belts made with multiple cords, there's a slight bump or "shoulder" where these cords overlap. This is the weak spot—over 80 per cent of belt breaks happen at this point. B. F. Goodrich grommet belts have no overlapping cords.

Big drive at Walt Keeler Co., where BFG distributor solved shutdown problem.

B.F.Goodrich GROMMET BELTS AT WORK

Why is one set of belts sagging and slipping while other set fits, runs perfectly? There's a big difference in cost too.

7-day stretch

When first installed, both of these drives were equipped with ordinary belts. But within 7 days belts had stretched so much the motor had been moved to end of slide rail. Photo at left shows how belts looked—permanently stretched.

Then B. F. Goodrich grommet V belts were put on both drives. No stretch at all after 6 months of 24-hour-a-day service, as photo at right shows. Both sets cost $75. Ordinary V belts cost $10 a day; grommet belts 10 cents a day.

The three preceding pages tell you why B. F. Goodrich grommet belts differ from ordinary V belts with actual examples to prove that they outlast ordinary belts—sometimes 10 to 1, at no extra cost.

Grommet V Belts BY
B.F. Goodrich

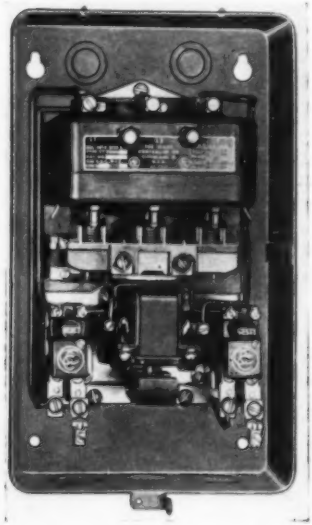
The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

(Continued from page 16)

excess pressure condition, the two or three valves open in progressive succession providing full rated discharge capacity of the assembly.

23—MOTOR STARTER HAS ARC EXTINGUISHER

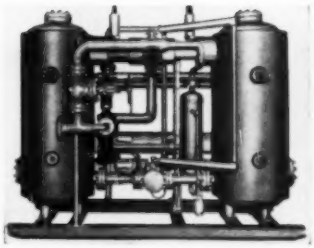
The Clark Controller Co. CY-2 starter for a-c motors introduces a new arc interrupting principle to the control industry and combines the use of strong multi-turn magnetic blowouts with twin break contacts. The advantages of both are combined in economical space. A steel case, enclosing each arc chamber, carries the flux and provides the ultimate in non-



carbonizing. The arc is extinguished by applying the effect of the blowout coil concentric with the contact. The steel arc chamber and center stud form the magnetic circuit around each contact. The magnetic field is concentrated in a cone from the steel center stud supporting the upper contact, to the steel rim in the lower arc shield surrounding the lower contact. In one current direction the arc is forced to the outer edge of the upper contact, lengthened and rotated. In the other, the arc is rotated and forced to the middle of the upper contact. In each case, the magnetic field tends to extinguish the arc, either by lengthening it or confining it.

24—FLUID DRYERS ADSORB MOISTURE

J. F. Pritchard & Co. has recently announced a new dual adsorber drying unit designated as the HYDRYER, Type A, for the continuous drying of compressed air or other gases to a dew point of minus (-) 40 F. Four other types are also available, each designed for specific service conditions. Units may be explosion proof, manual or fully automatic in control and may be enclosed for outdoor operation. Reactivation is accomplished by first heating the main fluid stream and passing it through the adsorbent bed. Adsorbed moisture is

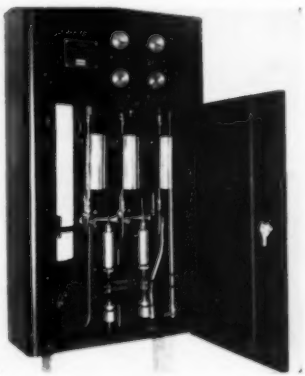


vaporized and discharged to a cooler where it is condensed and separated. The fluid stream then flows through the second adsorber to be dried. When the adsorbent in this vessel approaches the saturation point the cycle is reversed. The entire system operates under one pressure, and since no external air or gas is needed for reactivation, the fluid stream cannot become contaminated.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

25—STEAM SAMPLER HAS REDESIGNED CASE

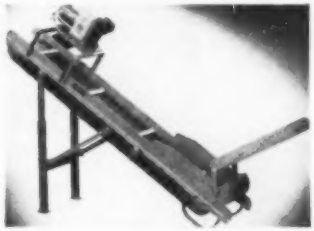
A model of the Hagan automatic degasser has been announced by Hagan Corp. that is distinguished by a new case of mild steel, finished in black and specially treated to minimize corrosion. This design makes disassembling the degasser easy. At the same time it increased the accessibility



of the interior mechanism. Structural members have been strengthened. Designed primarily for use in determination of steam purity the unit produces continuously and automatically an approximately 50-50 split of a flowing steam sample. One fraction contains any dissolved solids that may be present and the other any dissolved gases.

26—SMALL CONVEYER SEMI-STATIONARY

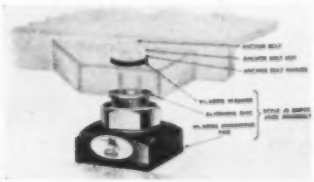
May-Fran Engineering, Inc. announces that the series "S" conveyer — designed primarily for permanent or semi-permanent installations — has been added to its line of materials handling equipment. Bolting is not necessary, and it can be moved readily when working areas or plant layouts change. Particularly useful as an auxiliary unit with a permanent conveyer system to feed or discharge high production items. Telescopic legs permit



the discharge end to be raised or lowered as required. In the four-foot size, the discharge end can be raised from the minimum of 27-1/2 to a maximum of 37 in.; in the six-foot size, from 37 to 57 in.; eight-foot length, from 30 to 70 in.; ten-foot, from 48 to 87 in.; and 12-ft size, from 56 to 96 in. Available with standard 12, 18 or 24 in. wide neoprene-impregnated fabric belts, but for applications involving excessive wear from hot or highly abrasive metal parts, the recently developed May-Fran hinged-steel belting can be supplied.

27—LEVELING JACK EASILY LOCATED

A leveling jack has been announced by the Enterprise Machine Parts Corp. that will support 20 ton and lift 8000 lb without overexertion on the wrench. Using a time proven principle, it vertically raises or lowers by simply turning the adjusting nut to right or left. Anchor bolt hole

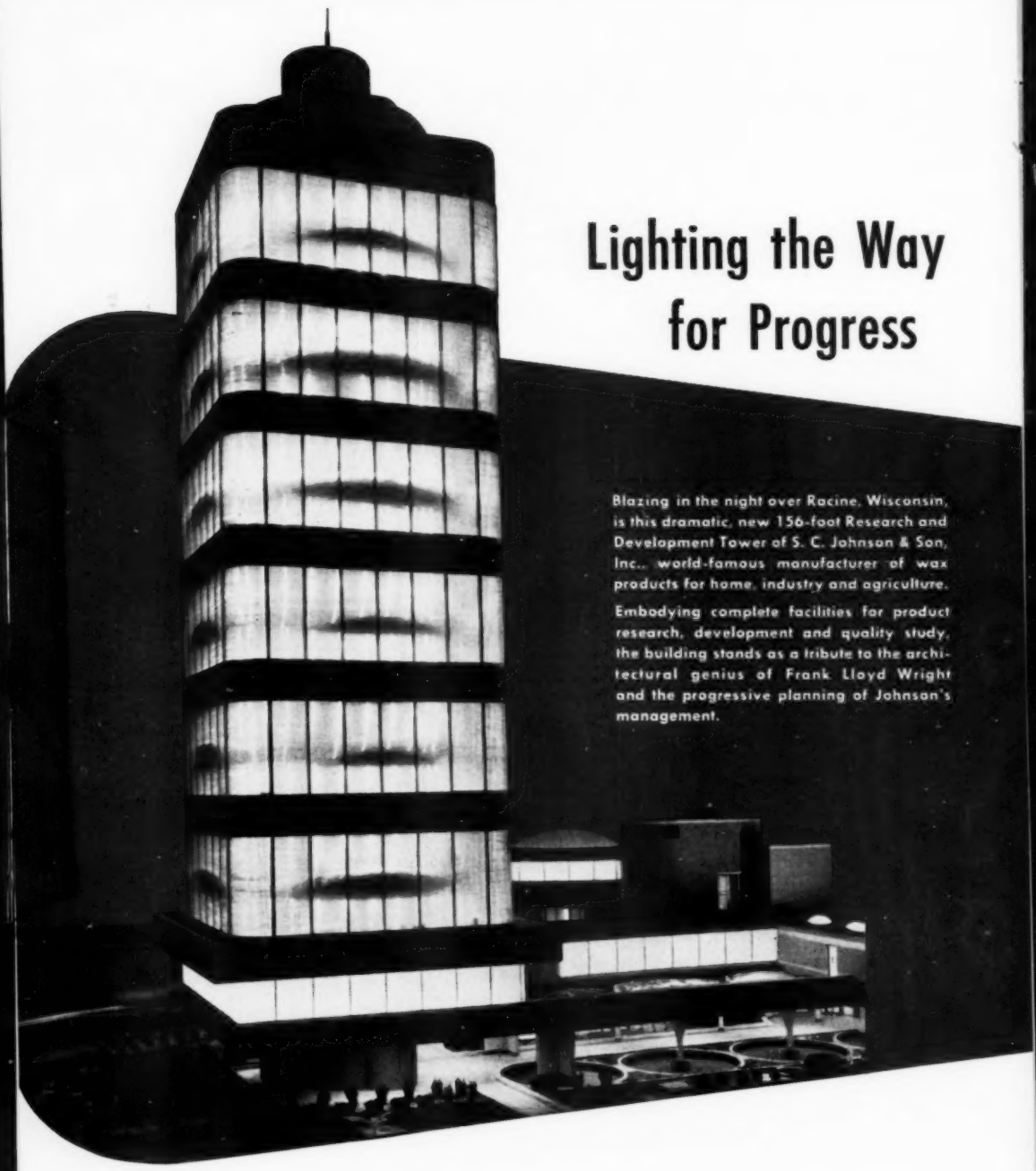


through the jack assembly allows clearance for 3/4 in. bolt, thereby making possible for the jack to be located at the precise point where equipment was designed to be best supported. To compensate for uneven floors, the top of lift screw has a concave spherical radius into which glides the convex spherical radius on the bottom face of the aligning disc. This permits sufficient float for the level alignment of machine while insuring maximum bearing. Special vibration absorbing felt is available in quarter inch thicknesses up to one inch. These pads are cut to fit the under part of jack base.

28—REDUCTION UNIT HAS 40 HP CAPACITY

A No. 6 unit has been added to the line of American Pulley Co. reduction units that will handle drives up to 40 hp and

(Continued on page 133)



Lighting the Way for Progress

Blazing in the night over Racine, Wisconsin, is this dramatic, new 156-foot Research and Development Tower of S. C. Johnson & Son, Inc., world-famous manufacturer of wax products for home, industry and agriculture.

Embodying complete facilities for product research, development and quality study, the building stands as a tribute to the architectural genius of Frank Lloyd Wright and the progressive planning of Johnson's management.

Protecting the Power for Progress

Inherent in the design of the tower is recognition that the researcher needs efficient lighting, flexibility of power supply for his equipment requirements, and uncontaminated air for obtaining true results from his efforts. Power for lighting, motor loads and air conditioning is supplied through a versatile power distribution system planned by Samuel R. Lewis & Associates, Engineers, Chicago. Protecting the system are an I-T-E coordinated outdoor substation, two I-T-E indoor unit substations, and an I-T-E distribution panelboard.

I-T-E Circuit Breaker Company—the center of switchgear progress—is proud of its contribution to the progress of Johnson's Wax.

The I-T-E Company

PHILADELPHIA PENNSYLVANIA

new bulletins and catalogs

Be sure to order your free copy of these booklets—they're the latest information published by leading manufacturers. Use the postage-free order cards on page 123. Just list the key numbers of the bulletins you want in the spaces provided on cards

BOILERS, AUXILIARIES, ACCESSORIES

200—Package Steam Generator. Completely assembled unit—finished, tested and certified at the factory—is illustrated and described in 6-page bulletin B3100. Lists features and contains a great deal of information in tabular form. Side and end view drawings of the fully-automatic 3-pass forced draft unit show placement of components. The Titusville Iron Works Co., Div. of Struthers Wells Corp.

201—Gas Burner Nozzles. Advantages of combining flame retaining nozzle and long sweep elbow into single unit are listed in 2-page catalog 804B. Sketch shows how discharge orifice is displaced outwardly from center line of curvature of elbow. The nozzle is said to operate with lower manifold pressure without back firing. Hauck Mfg. Co.

202—Refractories & Insulations. Catalogs R52 through I92, compiled in binder, make a 40-page booklet that tells the whole story of refractories and insulations. Shows where, when and how to use the various types of materials in industrial heat generating and processing equipment of all kinds. Of particular interest is table showing how to select proper thickness of insulating material. Contains helpful suggestions that should aid in solving refractory and insulation problems. Refractory & Insulation Corp.

203—Fuel Oil Heaters. For heating heavy grades of fuel oil with automatic control of oil temperature, Hauck offers its electric oil heaters. Catalog 709, 4 pages, gives complete data on the units. Advantages, methods of automatic operation, recommendations, characteristics and sizes are listed. Includes table on oil heating rates. Hauck Mfg. Co.

204—Oil Burning Manual. Informative 4-page manual should be valuable guide for proper installation and operation of oil-burning equipment. Includes among the 20 selected headings such important tables as "Air Flow Through Airports", "Available Draft", "Excess Air", "Boiler Pressure & Flue Gas Temperature". Cleveland Fuel Equipment Co.

205—Insulating Material. Kaylo calcium silicate products and their various uses are described fully in 24-page booklet. Part of the booklet is devoted to research and development history of hydrous calcium silicate products and description of its properties. Also outlines the various advantages of laminated panels and firedoors. Gives list of uses including heat insulation. Kaylo Div., Owens-Illinois Glass Co.

206—Steam Generators. Illustrated catalog offers choice of four types, in fifteen sizes, from 5 to 250 hp, for firing with gas, light or heavy oil, stoker-coal or by hand. Cutaway view shows arrangement of heating surfaces. Full discussion on construction and design features is included. In addition, the booklet mentions other products along with facilities for handling custom work to contract specifications. Hapman-Dutton Co.

207—Over-Fire Air Systems. "Burn the smoke" for cleaner, more efficient coal heating, says Canton Stoker and then shows how it's done in 8-page bulletin on Turbo-Aire over-fire air systems. Contains thorough discussion on principles of combustion and smoke elimination. Gives full description of the equipment along with cutaway and diagrammatic views showing units in action. Selection chart, specifications, and fan data and characteristics are included as is brief description of automatic controls. Three types of stokers are illustrated and short descriptions given. Canton Stoker Corp.

208—Block Insulation. Economic advantages and properties of Superex block insulation are listed in 4-page folder IN134A. Conductivity and heat loss graphs are given as is recommended thickness table. Drawings show shapes available. Johns-Manville.

209—Furnace Enclosures. Suspended arches and sectionally supported walls, and their application to all types of furnace enclosures are presented in 32-page bulletin No. 4. Efficient operation; ease of installation; low maintenance; these are some of the advantages outlined in the 2-color catalog. Drawings, cutaways and photographs portray the Duo-Seal construction. Of particular interest are series of charts showing heat losses from walls of varying thicknesses. Laclede Arch Co.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

210—Multi-Stage Turbines. Smaller framed, multi-stage turbines are featured in 6-page bulletin. Overspeed governor, governor valves, blades, diaphragms and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

211—Vertical Drive Steam Turbine. Concise 4-page booklet VT351 describes and gives technical data for vertical drive steam turbine. Built in three general sizes and handles industrial applications up to 600 hp with thrust loads of 8000 lb or more and steam conditions as high as 900 psig and 900 FTT. Includes other facts pertaining to such applications as geared circulating and boiler feed pumps. The Whiton Machine Co.

HEAT EXCHANGERS

212—Waste Heat Recovery. Illustrated 4-page bulletin covers utilization of unit heaters for recovery and distribution of waste heat from engine and compressor jacket water. Method of using waste heat to lower space heating costs is fully explained. Several installations are detailed to show piping hook-ups and control methods. Tells how to select correct unit heater size and type and gives typical example illustrating calculations. Performance tables show basic hot water capacities of the units. Modine Mfg. Co.

213—Unit Oil Coolers. Catalog 3550 on unit oil coolers gives design features, physical dimension data, etc. Recommended for oil cooling where cooling water is scarce and/or the waste heat can be utilized to warm room interiors, according to the booklet. Non-ferrous tube and fin type and available in nine sizes. Young Radiator Co.

214—Heat Exchangers. Bulletin ID151 illustrates wide variety of specialized heat transfer surfaces which have been developed for industrial use. Surfaces shown are applicable to such equipment as solvent recovery, intercooling, regeneration, gas separation and liquefaction, heat economizing and drying. Included are types providing as much as 300 to 350 sq ft of surface per cu ft of volume. Engineered to meet the specific requirements of individual applications and are manufactured only in large quantities. Modine Mfg. Co.

215—Heat Exchanger. If you must use dirty cooling water better look into the advantages of film type heat exchanger described in bulletin HE-7. Can be cleaned while in operation, according to the 8-page booklet which tells the whole story including design and construction features. Gives applications in several industries and shows installation photographs of various units. Henry Vogt Machine Co.

(Continued on page 27)

Another NORDBERG FIRST

the Supair Thermal Engine

THE MOST OUTSTANDING DEVELOPMENT IN MODERN DIESEL DESIGN

featuring:

- ★ ONE-THIRD MORE HORSEPOWER THAN CONVENTIONAL TURBO-CHARGED ENGINES
- ★ MORE HORSEPOWER IN LESS SPACE
- ★ MORE HORSEPOWER PER GALLON OF FUEL
- ★ MORE HORSEPOWER HOURS PER GALLON OF LUBE OIL
- ★ INCREASED THERMAL EFFICIENCY
- ★ LESS HEAT LOSS TO WATER JACKETS
- ★ LESS WEIGHT PER HORSEPOWER
- ★ LOWER INSTALLATION COST
- ★ LOWER OPERATING COST
- ★ LOWER MAINTENANCE COST

The *SUPAIRTHERMAL* Engine, the outstanding engine of the Diesel field, is available in a complete range of 4-cycle types for fuel oil, Duafuel, or spark ignition gas operation . . . for all applications, in sizes from 425 to 3200 B.H.P.

Write for further information on the *SUPAIRTHERMAL* Engine . . . the most outstanding development in a long line of famous Nordberg "FIRSTS".

NORDBERG MFG. CO.
Milwaukee 7, Wis.

BUSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

ALL FOR ONE...

but not one for all jobs!

All of these B&W Refractories are designed for one job . . . to give you the longest possible boiler furnace service.

BUT NO ONE refractory can meet all furnace conditions. That's why B&W has developed this complete line of cost-cutting refractories to solve every furnace problem.

Whether your boiler produces 10,000 or 1,000,000 lbs. of steam per hour, you can be sure of getting expert refractory recommendations from your B&W Refractories representative. He can show you how to decrease costs and increase furnace life with the proper B&W Refractory for your application. Drop us a postal card to obtain the name of your nearest B&W Refractories Engineer.

HEAVY FIREBRICK—

For oil fired furnaces with flame impingement or spalling or slagging conditions, either *B&W 80* or *Junior Firebrick* can be used. 80's assure uninterrupted service at extremely high ratings. Juniors are recommended where load bearing and temperature requirements are less severe, but too severe for the best grades of fire-clay brick.

INSULATING FIREBRICK—

B&W Insulating Firebrick have the lightest weight and lowest heat conductivity of any insulating firebrick in their class. They store and conduct less heat—withstand direct exposure to furnace gases. Available in six types for temperatures from 1600 F to 2900 F.

PLASTICS—

Used widely for repairs and for forming special shapes *in place*, B&W *Plastic Moldable* and *B&W Plastic Chrome Ore* offer long life under severe conditions. Plastic Moldable is suitable for use in the great majority of furnaces. It withstands temperatures up to 3000 F. Plastic Chrome Ore is ideally suited for severe slagging conditions.

CASTABLES—

In furnaces that require the high resistance of chrome to chemical attack and where speed of installation is important, B&W offers *Kromecast* for temperatures up to 3100 F and *Hydrochrome* for temperatures up to 2800 F.

For burner openings, door linings, walls, roofs and arches, B&W *Kaocast* possesses unusual volume stability and resists spalling. It easily withstands temperatures up to 3000 F.

B&W Baffle Mixes are excellent castables for the construction of monolithic boiler baffles, door linings and other general uses. They are smooth and flow easily, have high strength in small sections. Widely used to withstand temperatures as high as 2600 F.

B&W Insulating Concrete Mixes combine refractoriness, light weight and low heat conductivity with the ability to be poured like ordinary concrete. For temperatures up to 2200 F.

MORTARS—

B&W Mortars—Selecting the right mortar is vitally important to long refractory life. B&W Mortars pay for themselves by saving time in application and by satisfactorily performing their jobs under the designed furnace conditions.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST, NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

R-369

B&W REFRACTORIES PRODUCTS—B&W 80 Firebrick • B&W Junior Firebrick • B&W 80 Glass Tank Blocks • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

(Continued from page 24)

216—Fluid Coolers. Jacket water coolers for gas, gasoline, diesel engine and fluid cooling, said to be capable of withstanding the abuse of portable equipment installations, are illustrated and described in 4-page bulletin 1351. Many new design features are set forth in detail along with descriptions of optional accessories. Young Radiator Co.

WATER AND LIQUID TREATMENT

217—Water Softeners. Publication 3000 is a 68-page booklet describing and illustrating hot process softeners. Although recommending that each boiler plant should be studied carefully in conjunction with the available water to select the type of treatment and equipment best suited, the catalog discusses variations in the treatments that may be applied. Shows some of the designs that are available and have been successfully applied in practice. Cochrane Corp.

218—Water Treatment & Conditioning. Booklet 501, 16 pages, gives considerable technical data and describes services, products and methods employed in solving the many water problems encountered in industry. Treatments for boiler water, water lines, cooling water systems, brine systems, and waste water are all thoroughly covered. Included is a study of ten impurities common in water, the damage they cause and how to combat them. Brooks Chemicals, Inc.

219—Industrial Waste Treatment. "Four Ways to Economize on Industrial Wastes" is a 4-page technical paper that gives four steps in treating industrial waste. Deals with waste treatment in a general way and offers many suggestions that should be helpful. Gilbert Associates, Inc.

220—Cathodic Corrosion Control. Full discussion on the cathodic system of corrosion control is contained in 6-page bulletin. Gives causes of corrosion, its effect, and offers solution. Completely integrated service for survey, design, installation, material and servicing is outlined. The Harco Corp.

FILTERS, STRAINERS, CLARIFIERS, DEHYDRATORS

221—Oil Purifiers. Savings in oil consumption and equipment operating and maintenance costs in quenching, hydraulic and metal working operations are described in three 4-page illustrated bulletins. Actual quench oil purification problems and their solutions are discussed in one bulletin. Explains how installation of oil purification equipment has prolonged useful life of the oil, greatly extended periods between cleaning operations, and substantially reduced equipment downtime. Another bulletin tells how plants of all sizes have eliminated downtime, mechanical failures and expensive repairs on hydraulic equipment with hydraulic oil purifiers. Shows correct method and equipment used to keep hydraulic oil clear, clean and safe for use indefinitely. Third bulletin describes new magnetic filter; shows how unit removes contaminants from liquid coolant. Case history briefs further illustrate application of filtration equipment to various operations. Honan-Crane Corp.

222—Lime Hydrators. Continuous lime hydrators are described in 8-page bulletin 49. Covers the theory of lime hydration, as well as construction details, dimensions and capacities. Briefly discusses vertical and horizontal-rotary lime kilns, tube mills for hydrate grinding, conical mills for limestone reduction; continuous rotary dryers and regulating feeders. Hardinge Co., Inc.

223—Filters. Closed, pressure-type water filter is fully described in 16-page bulletin PF. Its operation is illustrated and explained, and the advantages over open gravity types for certain installations are pointed out. Installation photos show the various sizes and models, while charts give dimensions and capacities. Disc and poppet type valves are illustrated and described. Hungerford & Terry, Inc.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

224—Filters. The story of Flo-Clean, self-cleaning filter. Discusses construction and design advantages along with facts and figures on proven performances. Engineering information together with design data and flow tables are included in the 12-page bulletin. The Cuno Engineering Co.

ELECTRICAL EQUIPMENT

225—Electrical Fittings. Complete line of solderless wire connectors, cable and conduit fittings, and wiring devices are described in 12-page catalog 1050. Contains illustrated descriptive information on solderless wire splicing and terminating, plain and insulated conduit bushings, box connectors for metallic and non-metallic sheathed cables, conduit locknuts, etc. Includes complete specifications, dimensional data, application instructions and ordering information. Buchanan Electrical Products Corp.

226—Bus Duct Manual. Booklet B-4272A, 68 pages, describes types of bus duct and accessories available, and presents application and test data, specifications, information on pricing a typical bus duct installation, and a typical bill of materials. Lists advantages of bus duct for secondary power distribution system, and tells where bus duct can be used and specific advantages it offers. Illustrations include sketches showing dimensions of two-, three-, and four-wire bus duct. Technical section presents useful data, tables, and formulas along with voltage drop curves for low-impedance bus duct. Concludes with test data on plug-in bus duct and short-circuit stresses. Please use your company letterhead in requesting this manual. Westinghouse Electric Corp. Box 2099, Pittsburgh 30, Pa.

227—Transformers. Current, potential and metering transformers are the subject of 32-page illustrated bulletin S501B. Packed with technical information in the form of detailed drawings, accuracy limits, ratio and phase angle curves. Should be an aid to anyone working with instrument transformers. The Standard Transformer Co.

228—Specialty Transformers. Facilities for producing specialty transformers are described in 24-page brochure. Constant voltage transformers, lighting transformers, and specialty air cooled transformers, which are used in a wide variety of applications are pictured and described. Sola Electric Co.

229—Manual Starting Switches. Manual starting switch for fractional horsepower motors is featured in 8-page bulletin 600. Describes the switch in detail and is illustrated with photographs of typical installations. Also contains complete dimensional and engineering data, describes and illustrates features of each of the six models and a wide variety of standard enclosures for all service conditions. Allen-Bradley Co.

230—Power Factor Visualizer. Prepared in the form of a slide-rule-type chart, the power factor visualizer (SA6739) makes it possible to follow a hypothetical case involving low power factor and shows how the installation of capacitors can solve this, as well as many similar problems. The chart explains just what low power factor is, what it means to both the power user and the power supplier, and what benefits can be obtained by improving the power factor in industrial distribution systems through the installation of capacitors. Westinghouse Electric Corp.

231—TEFC Motors. Bulletin 05B715-OA describes types of construction and ratings of totally-enclosed, fan-cooled motors with tube-type, air-to-air heat exchangers. Included in the 6-page bulletin is a chart showing ratings of totally-enclosed motors available in squirrel-cage, wound-rotor and synchronous types for both horizontal and vertical installation, and a cross section view of horizontal motor construction features. Allis-Chalmers Mfg. Co.

232—Generator Controls. Bulletin GEA 5628 deals with 28-v generator control systems for multi-engined aircraft. The 8-page publication deals with a centralized system and shows how protection is provided against overvoltage, ground fault, reverse current and undervoltage. General Electric Co.

233—Foot Switch. Miniature foot switch is illustrated and described in 2-page bulletin. Explains that the switch is readily adapted to control of relays, solenoids, magnetic switches, and any units requiring instantaneous and accurate control of relatively low amperage loads. Actual size photo included. Simonds Machine Co., Inc.

234—Instrument Transformers. Illustrated 93-page brochure, GEA-4626, supplies pertinent buying information on instrument transformers. Divided

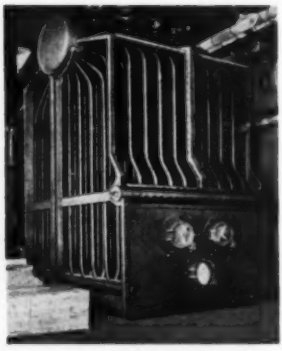
(Continued on page 28)

The construction facilitates conversion from oil to coal or coal to oil with minimum cost. The boiler design provides ample furnace volume for the various fuels.

Type KS Water-Tube Boilers By Bigelow are built in sizes ranging from 20,000 to 45,000 lbs. of steam per hr. Type KL Boiler sizes range from 35,000 to 70,000 lbs. of steam per hr. Type KV Boiler sizes range from 70,000 to 100,000 lbs. of steam per hr.

Compact—Low Maintenance—Low Fuel Cost.

Write for free catalog on the Types KS & KL or on any of the boilers listed below.



Bigelow Type KS-18 during erection at the E. & J. Gallo Winery, Modesto, Calif. Capacity 26,000 lbs. steam per hr., oil fired.

BOILERS BY BIGELOW

Water Tube Boilers — Bent Tube Types • Horizontal Return Tubular Boilers • Scotch Type Boilers • Two-Pass Boilers Electric Steam Generators

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.

BIGELOW REPRESENTATIVES: Boston • New York • Philadelphia • Syracuse • Detroit • Chicago • Atlanta • Milwaukee New Orleans • Oklahoma City • Petersburg, Va. • Washington, D.C. • Albuquerque • San Francisco • Seattle • Sumter, S. C.

BI 5

(Continued from page 27)

into sections which offer technical data on indoor and outdoor potential transformers, current transformers, metering outfits, potential and current portable transformers. Listings of ratio and phase-angle tests, coupled with tables covering the mechanical and thermal limits of current transformers, round out the balance of the publication. General Electric Company.

235—Large Induction Motors. Large, polyphase induction motor, and where it fits into the industrial picture, is the subject of 28-page booklet B-4739. Presents illustrated summary of types and features of two basic kinds of induction motors—squirrel cage and wound-rotor motors. Applications are illustrated for a number of industries. Westinghouse Electric Corp.

236—Single-Feeder Substations. Application of the CSP power transformer as completely packaged, single-feeder substation is described in 16-page bulletin B-4692. Combining the 43 components of conventional substation into single unit saves both time and money in planning, installing, maintaining, and moving the equipment, it is claimed. Illustrated description is included on tap changer equipment, automatic overload and short-circuit protection, instrumentation and instrument transformers, and low-voltage switching. Westinghouse Electric Corp.

INSTRUMENTS, CONTROLS, RECORDERS

237—Combustion Meter. Information on automatic CO_2 recorder is contained in 4-page condensed bulletin 51-553. Covers application and description of the orsat principle of operation, complete with detailed schematic drawing. Such features as temperature compensation and self leveling are explained; installation and sampling are illustrated and described. Handy selector chart included. The Hays Corp.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

238—Function Plotter. Instrument which automatically plots one variable in terms of another is described in 4-page data sheet 10.0-5. The instrument records the relationship between two variables, showing one as a function of the other. The data sheet gives numerous aplications for which the instrument is suited. It further describes the operation and instrument characteristics and gives other essential technical information. Minneapolis-Honeywell Regulator Co., Brown Instruments Div.

239—Multipoint Chart Recorder. Bulletin MPC1 explains how up to six permanent records of industrial processes may be obtained on one strip chart. The accuracy of deflection type measuring circuit, electronic link and simple chart printing mechanism used in the instru-

(Continued on page 30)

triple-threat to trouble!

A PROBE TYPE VACUUM TUBE VOLTMETER

As an a-c probe type vacuum tube voltmeter, ranges of 3 to 300 volts, frequency coverage extends from 50 cycles to 300 megacycles. Specially designed RF and D-C probes supplied.

AN ELECTRONIC VOLT-OHMMETER

Using 115 volts, 60 cycle external power, Model 769 is a stable electronic instrument providing 6 ranges from 3 to 1200 volts d-c full scale and 6 ohmmeter ranges to 2000 megohms full scale.

A VOLT-OHM-MILLIAMMETER

With self-contained power source, provides 6 d-c voltage ranges (10,000 ohms per volt)—6 a-c rectifier type voltage ranges (1,000 ohms per volt)—6 d-c current ranges and 3 ohmmeter ranges.

WESTON model 769

ULTRA HIGH FREQUENCY ELECTRONIC ANALYZER

Here is a truly versatile, three-in-one instrument that's a natural for those engaged in electronics production or maintenance. The entire instrument is protected from external RF influences. Its broad range and its complete stability make it ideally suited for AM, FM, and television testing, as well as for many applications in the HF and VHF fields. Uses standard commercial tubes, replaceable without recalibration. Extremely compact, Model 769 provides greater economy, greater convenience, because this one instrument provides for practically all electronic measurements. Literature available . . . WESTON Electrical Instrument Corporation, 605 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and TAGliabue instruments.

WESTON *Instruments*

DUO-STEP Leverage

It's startling news when a steam trap manufacturer suggests that you're using *too many* steam traps.

But if it takes *two* ordinary traps to do a job that can be done with *one* Clark Duo-Step, it's obviously a waste of money.

Here's how DUO-STEP doubles drainage capacity

Clark Duo-Step Leverage actually gives *double the drainage capacity* of old-fashioned traps. This saves you money three ways: (1) in original trap cost, (2) installation and (3) maintenance.

Ask your Clark representative for an eye-opener demonstration of Duo-Step on your own steam lines . . . or write us for additional information.

THE CLARK MANUFACTURING COMPANY
1854 East 38th St. • Cleveland 14, Ohio

(Continued from page 28)

ment are described. An open view illustrates arrangement of the basic recorder assemblies. Complete specifications and listing of models are included. Wheelco Instruments Co.

240—Miniature Speed Changer. Technical data sheet 4B describes miniature variable-ratio speed changer with lever adjustment. Diagram shows dimensions of the instrument as well as adjustments possible with the lever. Applications include all low power devices. Metron Instrument Co.

241—Potentiometer Controller. Engineering specifications of strip chart pneumatic control potentiometer are given in 2-page specification sheet 175. Advantages of pneumatic control combined with strip chart instrument are explained in detail. Specifications are included. Minneapolis-Honeywell Regulator Co., Brown Instrument Div.

242—Power Factor Meter. Economic benefits of high power factor may be easily obtained through application of direct reading, hook-on power-factor meter, according to bulletin GEA-5469. The 16-page booklet gives full description of the instrument together with on-the-job photos. Such other testing instruments as hook-on volt-ammeter, hook-on wattmeter, portable recorders, phase-sequence indicator, etc., also covered. General Electric Co.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

243—Flow Instruments. Years of experience—41 of them—enable Penn to offer a diversified line of instruments. The following bulletins are 4-page publications and are well illustrated with photographs, diagrams and cutaway views. Catalog 650 covers linameters, a variable area type of flow meter, recommended especially for fluids not suitable for orifice meters. Available in electric, electronic, mechanical and pneumatic models.

244—Pump by-pass control, for protection of high pressure centrifugal pumps against overheating at low flows, is the subject of catalog 925.

245—Magna-clutch flow controllers (differential pressure or variable area types) assure metering accuracy and operating convenience according to catalog 950.

246—Catalog 975 tells the story of automatic compensators for temperature and/or pressure. Full discussion of principles accompanied by formulas and diagrams is included. Penn Industrial Instrument Corp.

247—Electronic Equipment. Limited to industrial purchasing agents, this lavishly illustrated, 1053-page catalog lists products of the major manufacturers, complete with prices and discounts, and will serve as a valuable ready-reference buying guide. Lists industrial electronic parts and equipment for practi-

(Continued on page 32)

Lasts longer in corrosive service

Series 600
Gear-Operated
Gate Valve
with By-Pass

Success Stories from ALOYCO's Corrosion Clinic

THE CORROSIVE: Chemicals and solvents used in manufacture of synthetic androgen

THE PLACE: Ciba Pharmaceutical Products, Inc., Summit, N. J.

THE VALVE: ALOYCO gate valves, 100% stainless steel, machined with super-smooth seating surfaces, designed for quick disassembly for inspection and cleaning

THE RESULTS: ALOYCO valves installed in 1946 are still on the job—an astounding record!—with "maintenance practically nil"

Specialized techniques have been developed for the particular problems involved in casting and machining high alloy steels.

THE BACKGROUND: In the broad field of valve applications, ALOYCO concentrates in providing longer valve life when handling corrosive fluids . . . preventing product contamination and discoloration . . . and insuring protection at high or low temperatures.

We work in corrosion-resistant alloys exclusively. All our facilities are directed toward lengthening valve life in corrosion services. Result: *more* ALOYCO corrosion-resistant valves are used than any other brand.

Our *Aloyco Corrosion Clinic* offers *you* a specialized laboratory service for "diagnosing" and "treating" cases of too-frequent valve deterioration or product contamination due to valve corrosion.

For reduced valve costs and maximum protection of product purity, put your problem before the *Aloyco Corrosion Clinic.*

ALLOY STEEL PRODUCTS CO., INC.
1306 West Elizabeth Avenue, Linden, N. J.

The extraordinary service life of this ALOYCO gear-operated high-pressure gate valve . . . operating under severe corrosive conditions . . . is the result of a unique manufacturing service which includes:

A. Metallurgical research devoted *exclusively* to corrosive applications;

B. foundry and machine shop facilities set up for high alloy valves *only;*

C. casting and machining practices dictated by the difficult characteristics of the alloys required for corrosive services.

Longer Lasting
ALOYCO VALVES
1st in Corrosive Service

COMPACT

A 100 H.P. STEAM GENERATOR within arms' reach

MORE STEAM in LESS SPACE... at LESS COST!

The Clayton Forced Recirculation Steam Generator produces more steam per pound of weight and per cubic foot of space occupied than any boiler known... and at less cost. Fast steaming, automatic and safe, the Clayton Generator sets a new standard of efficiency for the production of processing steam. It is the only steam generator with a cost curve that parallels the load demand curve through all stages of operation. Each unit... 15 to 100 h. p.... is complete, ready to connect and operate upon delivery. No burners, pumps, instruments or accessories to buy.

THIS COUPON BRINGS PROOF TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

IP-7

CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA
Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

NAME_____
FIRM_____
ADDRESS_____ STATE_____
CITY_____

Clayton
MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

(Continued from page 30)

cally every industrial application. Write on company letterhead to Milo Radio & Electronic Corp., Dept. IP, 200 Greenwich St., New York 7, N. Y.

248—Heating Controls. Latest information on heating controls is contained in 60-page illustrated catalog. Simplified specifications, control system selection chart, thermostat heater data are included. Related controls are grouped together for quick reference. Cross index helps find specific items. Minneapolis-Honeywell Regulator Co.

BULK HANDLING EQUIPMENT

249—Pulverizers & Crushers. Swing hammer pulverizers and crushers illustrated and described in 36-page catalog 837 should help solve your reduction problems. Gives long list of applications to industries and materials. Contains full descriptions of both moderate duty and heavy duty units along with application recommendations. Tables give speeds, capacities and power when reducing various materials. Cutaway views show operating principle and working parts while sketches give dimensions of the units. The Jeffrey Mfg. Co.

250—Magnetic Separators. Complete descriptions of non-electric permanent magnetic separators along with pertinent engineering data including photographs, drawings and tabular specifications are given in 16-page catalog 15. Full explanation of permanent magnet life and the importance of application engineering are given. Contains information on proper separator selection. Eriez Mfg. Co.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

251—Magnetic Conveyer Elements. New principles in conveying skelp, plate, sheet, rod, bar pipe and shapes through installation of magnetic conveyer elements are illustrated and explained in 4-page bulletin 553. Gives varied applications and describes several typical installations. These include use on existing conveyers where single magnetic rolls are sufficient, and also where relatively narrow contour rolls of moderate magnetic traction are desirable. Types available, method of selection, and characteristics are listed. Eriez Manufacturing Co.

252—Tubular Conveyers. What they are; what they do; and how they're applied to move almost any flowable material—wet or dry—through any plane or angle is explained in illustrated bulletin. Lists applications and shows on-the-job photographs. Mentions manufacturing facilities along with other items produced by this company. Hapman-Dutton Co.

(Continued on page 143)

. . . with a background of twenty years

PHOTO BY EZRA STOLLER
THE AUSTIN COMPANY, ENGINEERS AND BUILDERS

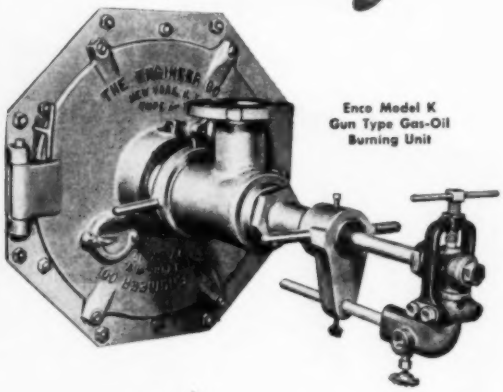
For over 20 years The Upjohn Company, Kalamazoo, Michigan has been a continuous user of ILLINOIS Automatic Steam and Fluid Control Equipment as an integral part of its air conditioning and vacuum heating systems and process control.
ILLINOIS Specialties meet fully the exacting requirements of this, "The World's Largest Industrial Air Conditioning Project".

Western Michigan Representative: **Marshall & Wells Company, Grand Rapids**

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

flexible... 3 ways

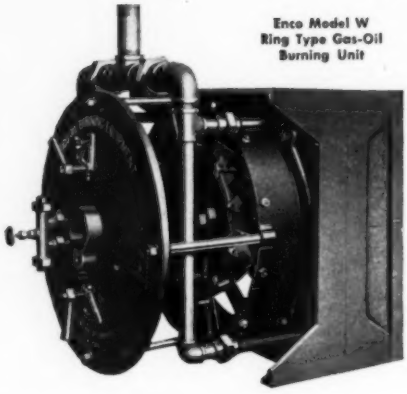
ENCO
OIL AND GAS BURNER UNITS



Enco Model K
Gun Type Gas-Oil
Burning Unit

These specially designed oil and gas burner units fit your needs . . . even when your operating conditions keep changing. Enco Oil and Gas Burner Units offer money-saving flexibility on three important counts. (1) They are designed for use with either oil or gas — or both . (2) They assure completely uniform combustion and greater fuel economy though steam demands swing sharply. (3) They can be operated by either natural or forced draft.

Even if your old combustion equipment "works", it pays to investigate the fuel-saving economies and full flexibility of these highly efficient units. Enco Burner Units are made in many sizes to suit all capacity requirements. Bulletin on request.



Enco Model W
Ring Type Gas-Oil
Burning Unit

ENCO
INTERCHANGEABLE ATOMIZERS
FOR USE WITH ALL TYPES OF BURNER EQUIPMENT

Wide Range Mechanical—Manual or automatic control. Constant high oil pressure at atomizer insures efficient atomization over entire load range without recirculating or returning oil.

Steam or Air—Wide range. Controlled by manual or automatic pressure regulation.

Standard Range Mechanical — Available in all sizes to suit load and capacity requirements.

Enco Standard Range Mechanical Atomizer Gun

Enco Wide Range Steam Atomizer Gun

Enco Wide Range Mechanical Atomizer Gun

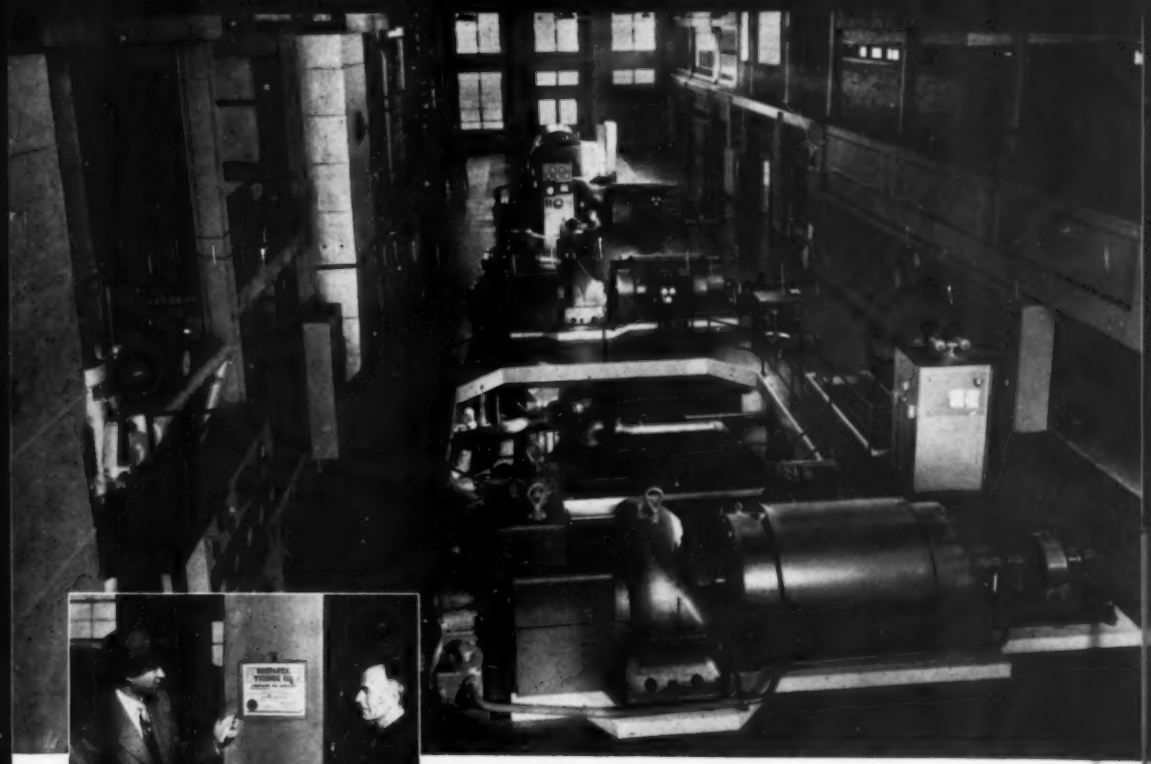
Enco Standard Atomizer Gun Support

Enco Gas Burning Gun

EC-483

THE ENGINEER COMPANY 75 WEST STREET, NEW YORK 6, NEW YORK

IN CANADA: F. J. RASKIN, LTD., 4230 IBERVILLE ST., MONTREAL 34 P.Q.



Above: Shown are four of the five big turbines of the Colorado Springs Municipal Utilities. NONPAREIL Turbine Oil helped operators "wash their hands" of oil-system maintenance troubles.

Left: J. J. Tyler (left), Standard Oil lubrication specialist, and W. J. Whelan, plant engineer, discuss the written guarantee given with each fill of NONPAREIL Turbine Oil.

Washed their hands of turbine-lubrication trouble!

NONPAREIL
TRADE MARK
Turbine Oil

Operators of the Colorado Springs Municipal Utilities had their hands full keeping oil systems clean in three big turbines. At least once a year, sludge and varnish had to be removed from the lubricating systems. Moreover, gradual deterioration of the lubricant used in the turbines made it necessary to replace fills of oil approximately every three years.

The recommendation of a Standard Oil lubrication specialist changed all of that. Operators took his advice and switched their turbines to NONPAREIL Turbine Oil.

Throughout ten years of operation, oil systems have stayed clean. The original fills of NONPAREIL have shown no appreciable deterioration, and neutralization numbers have remained below 0.10 KOH/gm. As a result, no fill of oil has needed to be replaced. The men of the Colorado Springs Municipal Utilities report: trouble-free lubrication by NONPAREIL has pared lubrication and maintenance costs to the bone! Since the switch to NONPAREIL, two new turbines have been added. Both of these units are lubricated with NONPAREIL Turbine Oil.

Trouble-free, low-cost lubrication is assured the Colorado Springs Municipal Utilities not only for 10 or 15 or 20 years but for the life of their turbines. This assurance is based on a written guarantee, given with each fill of oil to all NONPAREIL users, that NONPAREIL Turbine Oil will maintain a neutralization number below 0.15 KOH/gm. for the life of the turbine it lubricates. NONPAREIL has borne out its guarantee by having served, in individual turbines, for as long as 22 years without once being removed or replaced.

Ask a Standard Oil lubrication specialist to show you actual case histories from utility plants where NONPAREIL has reduced lubrication costs as much as 65%. You can reach a lubrication specialist by phoning your local Standard Oil Company (Indiana) office. Or, write:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Cut-away view of factory-lubricated Pierce torque converter transmission governor.

Left to right: F. C. Hess, Standard Oil lubrication specialist, W. E. Benjamin, Pierce Governor Company engineer, and A. C. Gartley, Standard Oil Lubrication Engineer, discuss vital part played by STANOLITH Grease in pre-lubrication of Pierce governors.

Elected for governor job . . .

TO INSURE trouble-free lubrication of their product in the field, officials of Pierce Governor Company, Inc., Anderson, Indiana, initiated the production of a factory-lubricated sealed unit type governor.

A special grease was found that did the job, but as production of the sealed units mounted, this grease became a costly production item. That's when STANOLITH Grease, recommended by a Standard Oil Lubrication Specialist, was tried. In test block runs simulating 10,000 hours of actual operation, at speeds ranging up to 4,000 RPM and temperatures from 150° F. to 200° F., STANOLITH did an even better job than the original lubricant.

STANOLITH factory-lubricated governors now have been in service for over eight months with no troubles resulting from bearing failures, overheating, or leakage of the lubricant. STANOLITH's lower cost has been an added advantage.

STANOLITH
TRADE MARK
Greases

This is one of many success stories reported by users of STANOLITH. For the beginning of your own lubrication success story, call your local Standard Oil (Indiana) office for the services of a lubrication specialist.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

What's YOUR problem?

F. C. Hess, of Standard Oil's Indianapolis, Indiana, office, is the Standard Oil lubrication specialist who recommended STANOLITH to operators of the Pierce Governor Company, Inc., enabling them to make an appreciable cut in production costs.

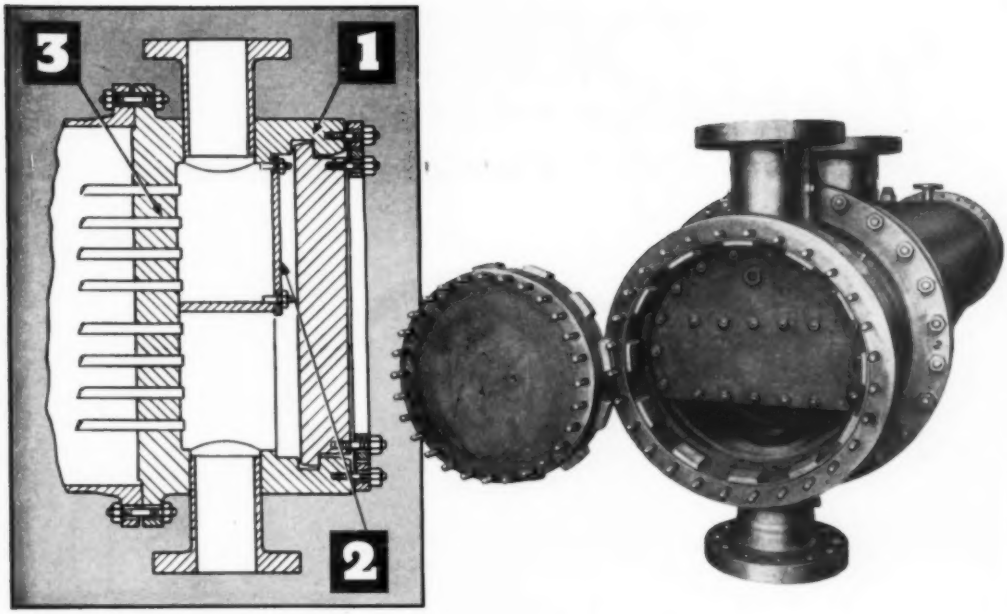
Throughout the Midwest there is a corps of specially trained, experienced lubrication specialists ready to give you prompt, on-the-spot help with any lubrication problem. Each of these men has been carefully trained in a Standard Oil Lubrication Engineering School. It's easy to get the services of a lubrication specialist — just phone or write to your local Standard Oil Company (Indiana) office. When he stops by to see you, ask him about the following fine Standard products:

STANOIL Industrial Oils - This general-purpose line of oils provides cleaner operation of hydraulic units and supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

CALUMET Viscous Lubricants - On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better internal lubrication of wire rope.

STANORUST Rust Preventives - The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD **STANDARD OIL COMPANY (INDIANA)**



Your 3 WAY protection against leakage in this G-R Feedwater Heater

1 At the water head covers

You know how the barrel and breech block in big guns are locked by lugs or projections. The same effective closure principle assures complete tightness for the water head covers of G-R High-Pressure Feedwater Heaters. In these units, interlocking lugs carry the hydraulic load . . . therefore no need for the large number of heavy bolts required by other high pressure heater designs.

2 At the pass partitions

Here's a fruitful source of leakage that can't even be detected in many designs of feedwater heaters. You'll have no worry on that score with G-R Feedwater Heaters, because in these units the differential in water pressure between passes helps to keep the partition joints *tight* instead of tending to force them apart. The sketch tells the story.

3 At the tube sheet joints

83 Years of experience in building heat transfer apparatus have taught G-R how to make tube sheet joints *lastingly* tight. This unequalled experience . . . based on the results obtained in many hundreds of thousands of installed units . . . is your assurance of uniformly thorough tightness of all tube ends in every tube sheet.

Write for bulletin describing G-R Feedwater Heaters in detail.

THE GRISCOM-RUSSELL CO., 285 MADISON AVE., NEW YORK 17, N. Y.

GR 260

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

"Moving" examples of **Flexible Connector jobs**

EXTENSION "FINGERS" FOR TIGHT SPOTS Have you ever dropped a screw or small part in a tight spot where your own fingers can't get at it? Then you'll appreciate these mechanical "fingers" which work around corners, even in a figure "s." They stay put, they grip and twist. Made by Aircraft Specialties, Inc., Lapeer, Michigan, from American 7/32 in. I.D. Lamp Arm Tubing.

The right move is to use American Flexible Metal Hose or Seamless Tubing wherever connectors must be flexible, absorb vibration, stand punishment of almost any kind. For close connections, for misaligned ports, for resisting heat, pressure and corrosion, let us suggest the right connector for the job.

Bulletins SS-50 and CC-300 contain information you ought to have about these versatile products. For your copies, write The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

A1231

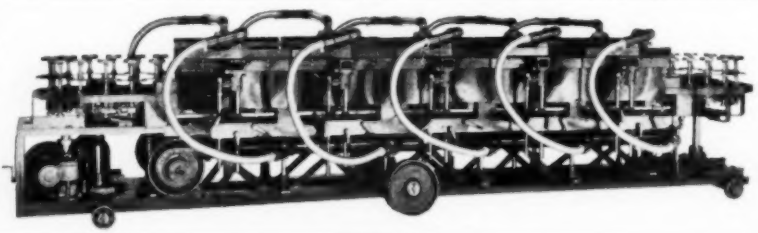
wherever connectors must move...

American ANACONDA

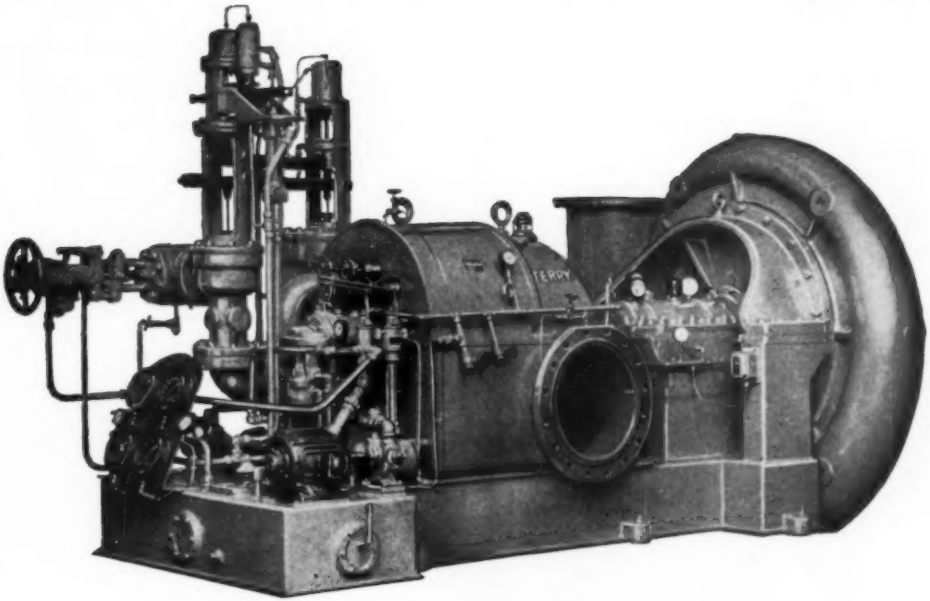
FLEXIBLE METAL HOSE AND TUBING

MOVES WITH VIBRATION — Lubricant is carried under pressure through 1-in. and 2-in. American Flexible Metal Hose Connectors to bearings and rolls of this 18-in., 4-high rolling mill. Vibration can never break these connectors.

TO "COOK" A SMOOTH DISH — American Flexible Metal Hose conveys gas to burners of this A. B. Knight glazing and polishing machine for finishing pressed tumblers, plates and dishes. Flexible connectors permit burner adjustment to products of varying size and shape.



The TERRY TURBINE



SPECIAL PURPOSE TURBINE

FOR OPERATION UNDER ALL THESE CONDITIONS:

1. Straight, high-pressure, condensing
2. Straight, low-pressure, condensing—putting to work excess low-pressure steam.
3. Mixed pressure — using the low-pressure steam available, with only enough high-pressure steam required to drive the compressor
4. Condensing bleeder operation — providing clean, low-pressure steam for heating or process work

. . . and the speed under any of these conditions can be varied from 2800 to 4750 rpm.

This is but one example of many unusual combinations developed by Terry to meet out-of-the-ordinary requirements in turbines up to 2000 hp. Information on a special-purpose turbine for your specific requirements will be gladly furnished.

T1177

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH R/M

The Raybestos-Manhattan packings in the stuffing box of this hydraulic accumulator ram play an important part in the machine's successful operation. The complete line of R/M packings and gaskets plays an important part in the successful operation of valves, compressors, pumps, hydraulic and other equipment of all types. The R/M distributor near you will gladly help select the right R/M packing or gasket to meet your needs. Or write for the new R/M Packing Catalog.

R/M PACKINGS

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

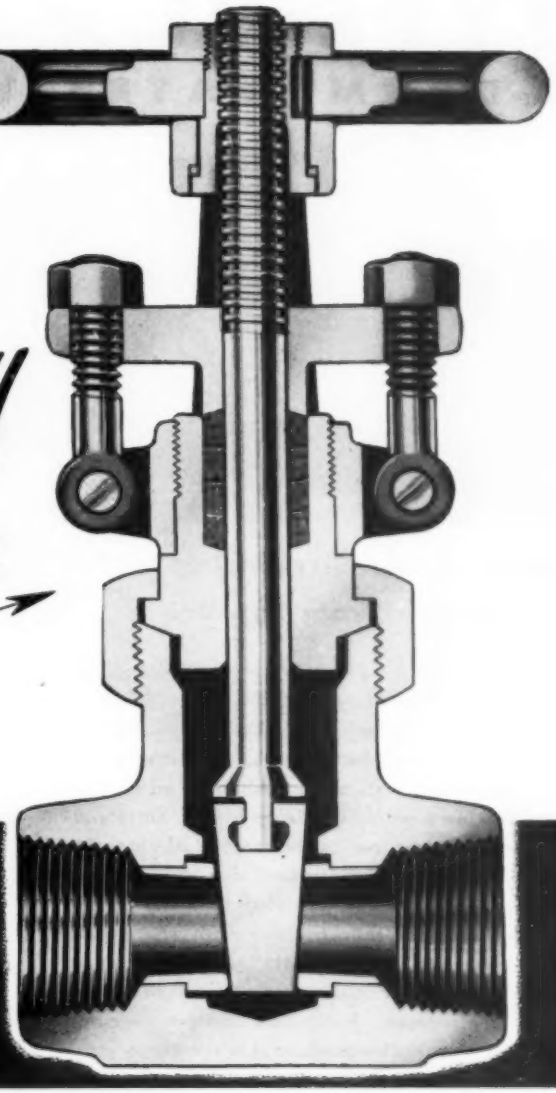
FACTORIES: Bridgeport, Conn. Manheim, Pa.
No. Charleston, S.C. Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings - Asbestos Textiles - Mechanical Rubber Products - Abrasive and Diamond Wheels - Rubber Covered Equipment - Brake Linings - Brake Blocks - Clutch Facings - Fan Belts Radiator Hose - Powdered Metal Products - Bowling Balls

You can

Repack Under Full Pressure

with a



Chapman List 960

No pressure is transmitted to the stuffing box of a Chapman List 960 when the valve is in the open position . . . you can always repack it easily, fast, without stopping the flow through the valve. What's more, it's a tougher — more rugged — valve that reduces many other maintenance problems.

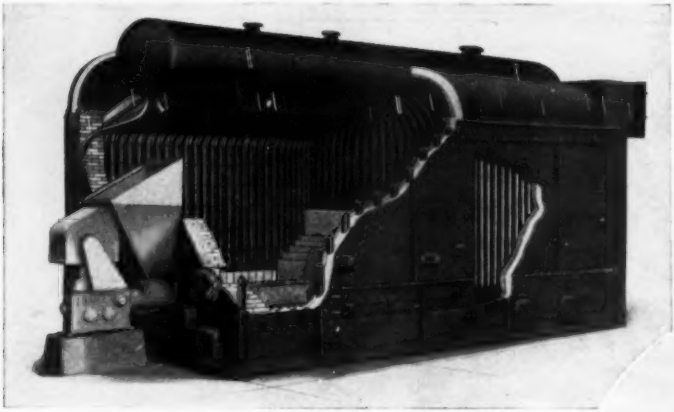
Take for instance, the wedge faces — they're hardened to 800 Brinell by the exclusive Malcomizing process to give peak wear resistance. Seat rings, too, have unusual wear-resisting and non-galling characteristics. And, in addition, recent design changes have resulted in stem and wedge gate connections 50% stronger than before.

Write *today* for detailed technical information. The Chapman List 960 is available in sizes from ¼" to 2", either metal to metal or gasketed joint. Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. For higher pressures specify List 990.

The Chapman Valve Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

TYPE-VL *A Low Headroom*
2-DRUM WATER WALL BOILER

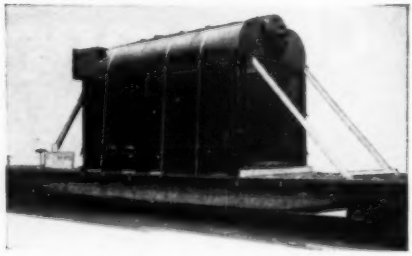


SHIPPED BUILT-UP IN SIZES TO 300 H. P.

Clean, Quiet, Circulating Water Taken From Top Drum

BACKED by a long experience gained in the manufacture of over 500,000 H.P. of Erie City 2-drum water tube boilers and of thousands of complete built-up boiler units, Erie City has incorporated side wall water cooling as an integral part of a low headroom 2-drum boiler. Outstanding of many features, is the method of obtaining a ring flow circulation, in each side wall element. A downcomer tube is provided for each pair of radiant (riser) tubes in the side wall, which, with two front wall downcomers assure an ample supply of clean circulating water in the water walls at all times. Insulation between riser and downcomer tubes keeps water at lower temperature in the downcomers while heat is rapidly removed from refractory through risers. Write for VL bulletin that clearly describes and illustrates this and many other features.

Water Wall tube arrangement—1 Downcomer for each 2 Riser Tubes



Shop assembled and shipped as a unit in sizes to 300 H. P.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Types VL & VC 2-Drum Boilers • "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • "Keystone" Packaged Steam Generators • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

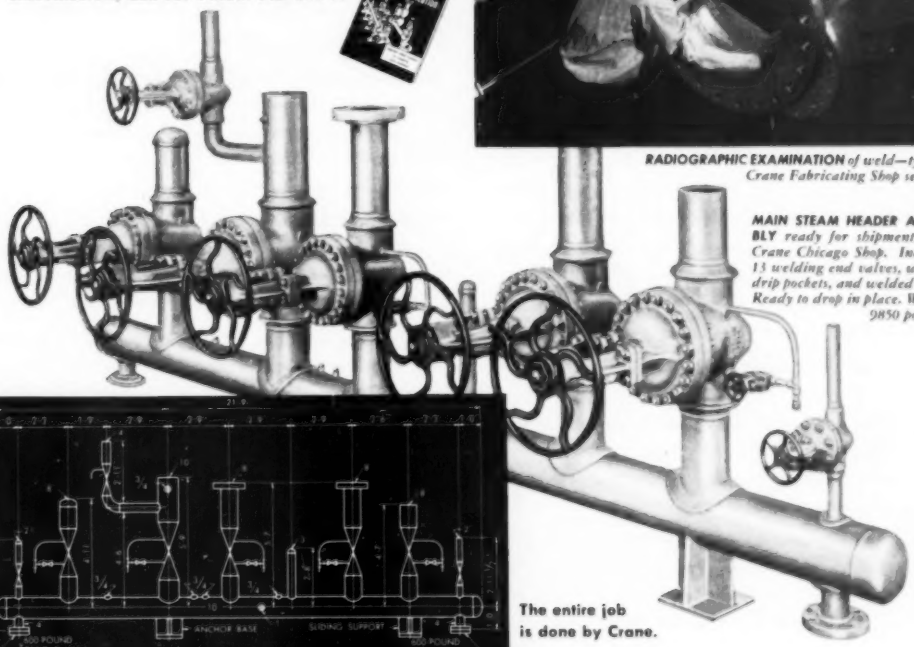
no unit fabrication job too tough for CRANE

Whether your piping project calls for a simple pipe bend . . . or a complex welded assembly . . . Crane fabricating facilities can handle it. No pipe shop is better equipped to do your *entire* job from drawings of *your* design.

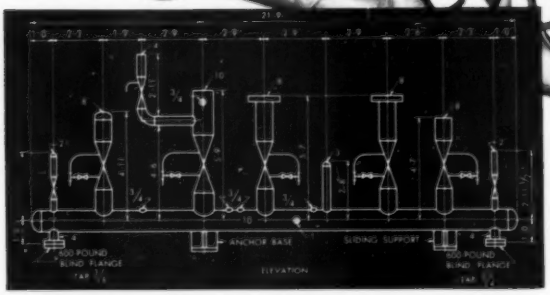
At Crane all steps of fabrication—such as bending, welding, stress relieving or heat-treating, radiographic examination, hydrostatic testing—are rigidly checked under procedure control to maintain adequate standards of accuracy and quality.

And because each assembly is tested as a unit, with major assemblies proved in advance of installation—you can erect your piping systems with minimum expense and delay. For further information, **ask for Folder AD-1771.**

RADIOGRAPHIC EXAMINATION *of weld—typical Crane Fabricating Shop service.*



MAIN STEAM HEADER ASSEMBLY *ready for shipment from Crane Chicago Shop. Includes 13 welding end valves, welded drip pockets, and welded bases. Ready to drop in place. Weight 9850 pounds.*



The entire job is done by Crane.

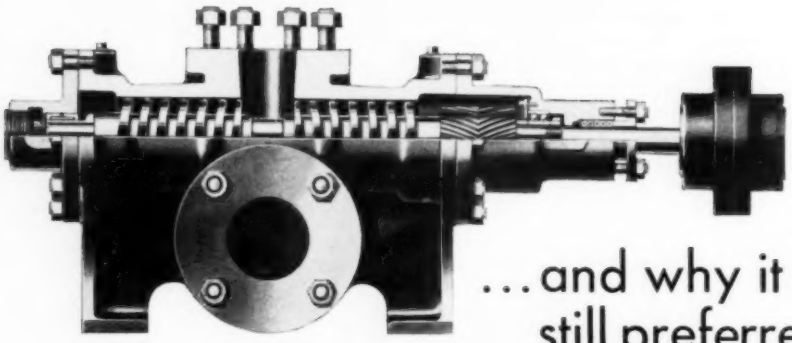
CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

QUIMBY

...the Original Screw Pump



...and why it is still preferred

100% Anti-friction bearing equipped. Due to their rolling action and minimum lubricating requirements, anti-friction bearings maintain their original clearances without appreciable wear. No hydraulic shock or discharge pressure loads on the bearings because Warren-Quimby Screw Pumps are 100% balanced axially.

Quadruple non-slip screws. A specially generated curvature is now used, producing a straight line contour between screws, essentially eliminating all slippage between these elements. Closer clearances without metallic contact insure higher efficiencies over longer periods.

Balanced power, pulseless discharge. No special foundations or bolting required for successful operation. Smooth running and quiet, with a minimum of churning or foaming of liquid handled.

No stuffing box troubles. In general, there are no packing troubles with Warren-Quimby Screw Pumps. By using sets of opposed intermeshing pumping screws, the flow of liquid is from each end toward the center, insuring suction pressure only on the stuffing boxes.

Herringbone Driving Gears. Smoother flow of power from the driving shaft to the idler shaft is accomplished by multi-tooth, precision cut, full herringbone gears. These gears are so positioned and timed as to maintain a definite clearance between the pumping screw elements.

Positioning Bearing. A fixed ball or roller bearing on the drive shaft effectively absorbs all external thrust loads. This permits full floating screw elements, free to expand at elevated temperatures without harm to the pump.

Interchangeability. All parts, excepting the body and length of screws and shafts, are interchangeable with corresponding sizes in the gear-in-head and external bearing designs.

The most complete line of Screw Pumps in the industry.

Insist upon the original... now owned, manufactured, marketed, serviced and guaranteed by Warren . . . one of America's pioneers of the pump industry. Write for bulletin S-204.

PQ-1

WARREN QUIMBY PUMPS

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

DURANICKEL

A wrought, age-hardenable, corrosion-resisting alloy

Duranickel® is a wrought, non-ferrous, slightly magnetic alloy. It has the higher strength found only in the heat-treated alloy steels, and not offered by other corrosion-resisting alloys available at comparable cost levels.

The principal engineering characteristics of Duranickel are:

● **Mechanical Properties:** The accompanying table shows the ranges of Ultimate Tensile Strength, Yield Strength, Elongation, and Hardness values for various forms and conditions of Duranickel.

● **Shear Strength:** Values for the ratio of maximum shearing strength to ultimate tensile strength range from approximately 0.5 to 0.6 and are comparable to those of mild and low-alloy steels.

● **Endurance Limit:** In rotating beam tests of polished specimens at room temperature and 10,000 rpm for 10^8 cycles, Duranickel hot-rolled showed an endurance limit of 51,000 psi.; hot-rolled, age-hardened showed 52,500 psi.; cold-drawn 51,000 psi.; and cold-drawn, age-hardened showed 61,000 psi.

● **Impact Strength:** Charpy impact strength ranges from 240 ft. lb. for hot-rolled Duranickel and 190 ft. lb. for cold-drawn, to 40 ft. lb., for the age-hardened condition.

● **Spring Properties:** Duranickel wire can be cold-drawn and age-hardened subsequently to develop tensile strength of the order of 225,000 psi. The torsional proportional limit of cold-drawn and age-hardened wire is about 40 per cent of the ultimate tensile strength. Duranickel springs are used at temperatures up to 550°F.; the stresses used should be governed by existing service conditions.

● **Working Characteristics:** Duranickel may be hot-worked, forged, and cold-worked. It can be machined most readily in the annealed condition and is commercially machinable in other conditions at hardnesses up to 275 BHN. The use of a cutting lubricant is essential for all machining work because Duranickel, like all high-nickel alloys, is characteristically "sticky" and tends to gall or build up on the tools. Duranickel can be joined by the usual welding, brazing and soft soldering processes common to industry.

● **Variants:** For special uses there are two alloys similar to Duranickel. They are: (1) Duranickel "R" containing a higher percentage of carbon for use where applications require optimum machinability. (2) Permanickel® having the same mechanical properties as Duranickel but different physical constants, particularly better electrical and thermal conductivity and stronger magnetic properties. Permanickel is preferred for service as springs requiring high electrical conductivity; equipment requiring good thermal conductivity and magnetostrictive units where high fatigue strength is required. Special applications include thermostat tension springs, reaction springs, clips, grid wires and side rods in vacuum tubes.

● **Corrosion Resistance:** The corrosion resistance of Duranickel in all its forms is of the same order as that of nickel to a wide variety of media, including mineral and organic acids, alkalies, salts, potable and industrial waters, food products, organic compounds and oxidizing atmospheres at normal and elevated temperatures.

● **Forms Produced:** Duranickel is supplied in most commonly used mill forms—rods, hexagons, squares, rounds, flats, strip, sheet, wire and welding materials.

● **Applications:** Duranickel is used in many applications where corrosion resistance, high hardness, and great strength are required. In the production of plastics, Duranickel is a standard material for dies, injection cylinders and extrusion screws. Duranickel springs, from both wire and strip, give excellent service. Instrument parts include diaphragms, bellows, flapper valve discs, snap switch blades, and grid wires and side rods in vacuum tubes.

Mechanical Property Ranges of Duranickel

Form and Condition	Tensile Strength 1000 psi.	Yield Strength (0.2% offset) 1000 psi.	Elongation in 2 in. per cent	Hardness Rockwell C
Rod and Bar				
Hot-finished	90-130	35-90	55-30	75B-22
Hot-finished, age-hardened	160-200	115-150	30-15	32-42
Cold-drawn, as-drawn	110-150	60-130	35-15	90B-32
Cold-drawn, age-hardened	170-210	125-175	25-15	32-42
Strip				
½ hard	130-155	.....	15-3	25-34
½ hard, age-hardened	170-210	.....	20-7	33-42
Spring	155-190	.....	10-2	30-40
Spring, age-hardened	180-230	.....	15-5	36-46
Wire				
Spring	160-200	.....	5-2	....
Spring, age-hardened	200-240	.....	10-5	....

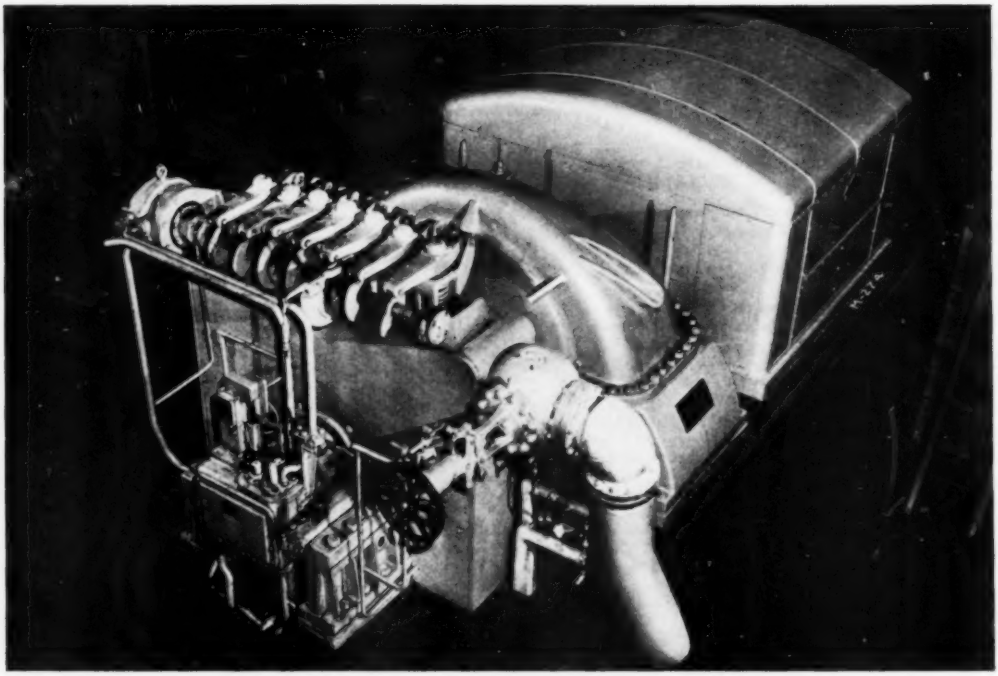
FURTHER DATA AVAILABLE

A 22-page reference manual, *Engineering Properties of Duranickel*, Technical Bulletin T-32, contains all essential engineering information. It is available, free, for your files. For help on specific metal problems, write directly to Inco's Technical Service, outlining your problems.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

INCO Nickel Alloys

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • INCONEL® • NICKEL • "L"® NICKEL
DURANICKEL® • PERMANICKEL®



Side-Mounted Coolers

simplify turbine installation

This 5000 kw Worthington turbine generator was installed several years ago by a midwest cement producer.

The generator is equipped with split, side-mounted air coolers. This arrangement is desirable where it is necessary to save basement space below the unit. These coolers are readily accessible, and each can be cleaned while the unit is in operation.

Selection of a Worthington turbine generator gives *unit responsibility* for design, assembly and performance. All Worthington turbines and generators are tested *together* as a unit before shipment.

Worthington builds turbine-generator sets in sizes up to 10,000 kw. For detailed proof that *there's more worth in Worthington* . . . call our nearest office or write to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.

WORTHINGTON

STEAM TURBINE GENERATORS

T.1.5

A GREAT TEAM IN STEAM

Foundries...First Aid Stations...Parts Storage...Laboratories...Process Drying

Trane Air Conditioning Serves Everywhere in Industry

Industrial heating and air conditioning problems large or small can be effectively solved with products from the complete Trane line.

In Foundries—Plenty of conveyors make a new midwest metal working plant a foundryman's dream. Conveyors, however, seldom mix with conventional heaters because they vie for the same space. But the conflict was resolved with Trane Projection Heaters that tuck away close to the ceiling high above the machinery.

In First Aid Stations—Good first aid practice calls for a station centrally located in the plant, as well as cleanliness. Unfortunately the best spot in a certain Chicago plant was also the dustiest—and warmest. Yet the station got the right location with a Trane Climate Changer that filters outside air and cools it properly.

In Parts Storage—Parts for assembly needed protection against cold in an auto manufacturer's warehouse. Heating system had to maintain minimum temperatures at lowest cost. Trane Projection Heaters do the job by dispatching heat, as it rises, to the floor line to equalize temperatures.

In Laboratories—Space was the problem in the laboratory of a chemical manufacturer and yet there had to be room for heating. This battle of inches was won by Trane Convectors. Recessed into the wall they eliminated the overheated zone that surrounds most room heaters.

In Process Drying—An eastern manufacturer who makes drying equipment needed a substantially constructed low cost source of heat. Yet the heating equipment would have to be shoe-horned into the smallest space. Trane Heating Coils qualified for requirements and the drying problem was solved.

Whether it's foundries, first aid stations, parts storage, laboratories or drying rooms, Trane heating and air conditioning serves everywhere in industry.

Whatever your heating, cooling, ventilating or air conditioning problem is, look for the answer in the complete Trane line.

In Parts Storage Space—Trane Projection Heaters salvage ceiling heat.

In Laboratories—Trane Convectors recessed in the wall heat this laboratory.

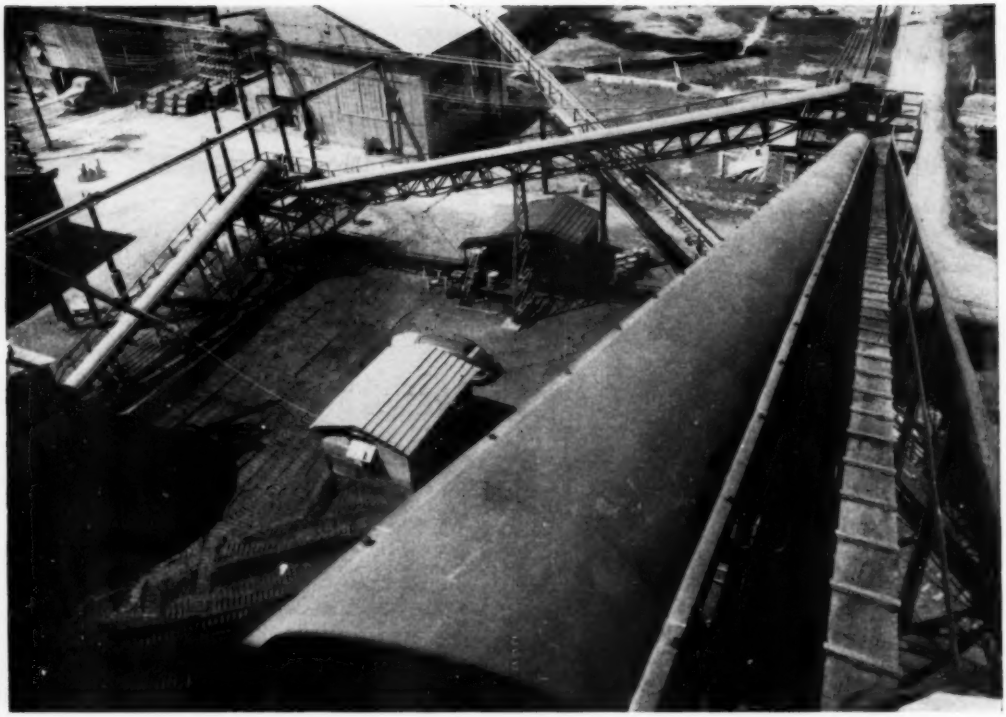
In Process Drying—Trane Heating Coils, the lightweight space saving answer for textile dryers.

TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division . . . Scranton, Pa.
Trane Company of Canada, Ltd., Toronto

OFFICES IN 80 U.S. and 14 CANADIAN CITIES



Power Plant Coal Steps Upstairs...

62 Foot Lift in Restricted Space Via BELT CONVEYORS

On every specification, this S-A Belt Conveyor System meets the individual needs of this coal handling installation—1. Required volume; 2. Operation in a small area; 3. Lowest cost per ton handled. It is designed to handle 50 tons per hour of minus 2″ coal.

In its details, this system is typical of the many special-purpose materials handling installations designed by S-A engineers during the past 50 years. Because Stephens-Adamson makes *all* types of bulk conveying equipment, the S-A engineer is able to recommend the most desirable combination of equipment units for the job—*to keep handling costs at a minimum*.

If YOU have a bulk materials handling problem that involves a new or remodelled conveying system, write us today. See what S-A engineers can suggest.

This S-A Belt Conveyor System conveys power plant coal from track hopper and belt feeder to the top of the boiler house—62 feet above track level. The total ground area occupied by the installation is comparatively small. The first belt lifts coal through a coal weighing station. All belt conveyors are covered by steel hoods for protection against the weather. Additional coal can be stored on ground area bounded by the conveyors for later reclaiming to the track hopper.

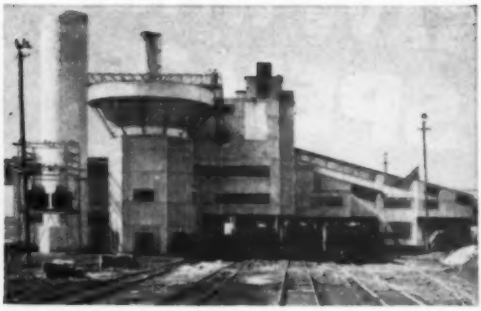
1901-1951

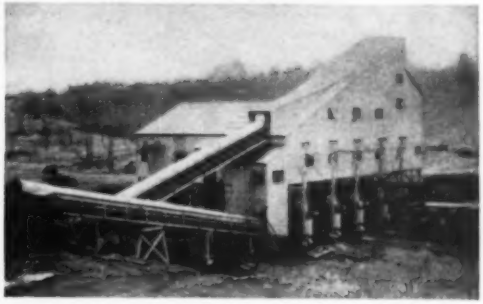
50 years experience with bulk handling

STEPHEN S-A ADAMSON MFG. CO.

21 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT





Huge, modern cleaning plants, where coal is correctly washed, processed and sized right at the mines, are an important part of Bell & Zoller's dependable service to industrial coal users.

Dependability... costs you no more!

The best coal supplier for you is the most dependable one you can find. It's his job to analyze your equipment and the demands upon it, recommend the most suitable coal at the lowest cost, and deliver that coal without interruption. His responsibility begins at the mine and ends only with your complete satisfaction.

Hundreds of coal buyers throughout the Midwest know and count on Bell & Zoller dependability. Sixty-five years of service plus more than 5½ million tons annual production of top-quality coals from nine shaft mines in Southern Illinois, Central Illinois and Western Kentucky, make Bell & Zoller their first-choice coal supplier.

Right now is a good time to have a B & Z combustion engineer make a thorough analysis of your steam producing equipment and show you how steam costs can be reduced. Write or phone today for immediate consultation.

ENGINEERING METERED COAL HEATING SERVICE

BELL & ZOLLER COAL COMPANY

BELL BUILDING, CHICAGO 1, ILLINOIS

ST. LOUIS • NASHVILLE • OMAHA • MINNEAPOLIS

Sixty-Five Years of Service to Coal Users

Producers of
ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, JEFFCO, BUCKHORN, MOUNT OLIVE and STAUNTON Coals

Sales Agents for
Mulberry Hill Coal Company
Freeburg, Illinois

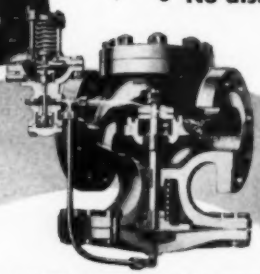
Otter-Eagle Coal Company
Lockwood, West Virginia

Boone County Coal Corporation
Sharples, West Virginia

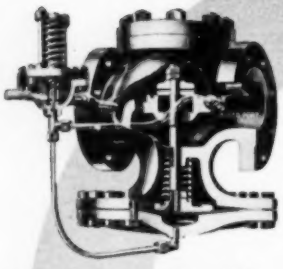
SAVE WITH SPENCE on all these jobs

Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:

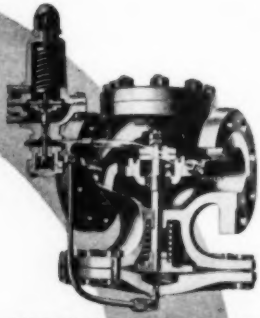
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.



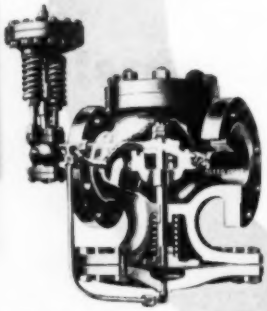
BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



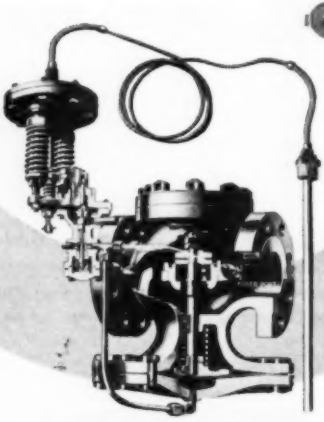
DIFFERENTIAL PRESSURE—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

WRITE FOR BULLETIN 350

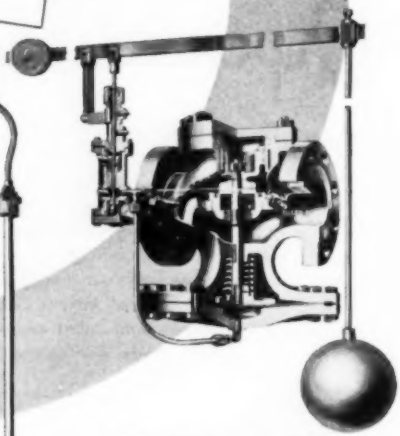
for complete details on Spence's line of automatic regulating valves



PUMP GOVERNOR—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

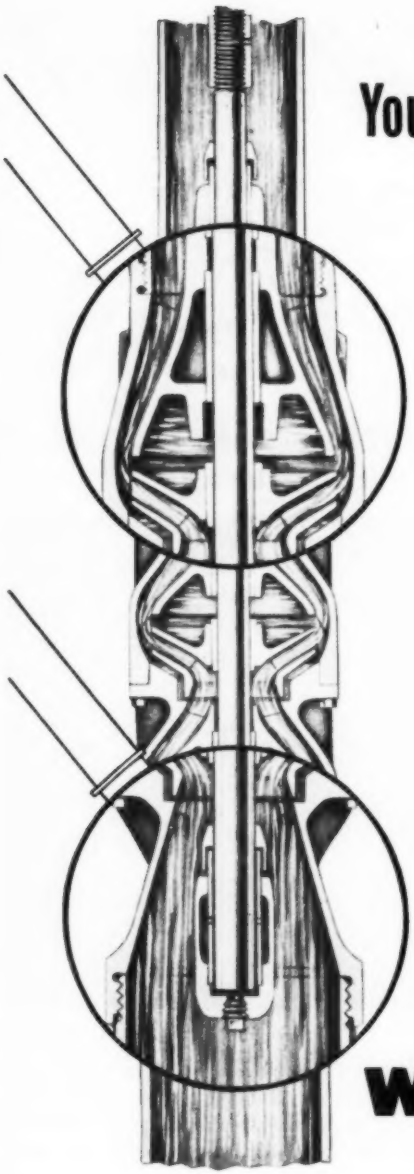


LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

DE-119

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence



You Can't Lose Your Bearings

when you follow the tip to buy WORTHINGTON

When you buy a vertical turbine pump, be sure the top and bottom bearings are well protected.

Here's the protection Worthington gives the bearings of *its* pump—better protection than you'll find in any other vertical turbine pump.

Bottom bearing. It's grease-packed and won't need attention for the life of the pump. Tests of grease-packed bearing versus rubber bearing show the advantage greatly in favor of the former.

Top bearing of oil-lubricated models. Seals above and below the drain ports keep out abrasives which would cause wear and damaging vibration. They also prevent water from entering the tube, which could cause emulsification of the oil and accelerated wear of the line shaft—a Worthington exclusive.

Sand collars. In water-lubricated models, sand collars at both ends of bowl assembly provide further protection by keeping abrasives away from the bearings.

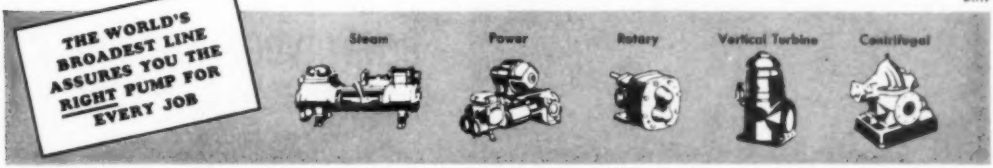
Worthington Vertical Turbine Pumps are available in sizes from 6 in. up, to handle liquids at temperatures of minus 7F. to 500F., with maximum head per stage over the entire size range.

For other Worthington exclusives—such as flanged and bolted bowls in *all* sizes—write to Vertical Turbine Pump Division, Worthington Pump and Machinery Corporation, Harrison, New Jersey or Denver 16, Colorado.

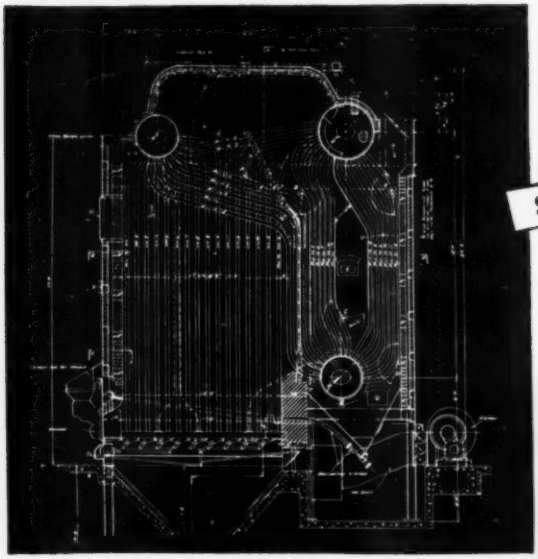
WORTHINGTON

D.1.9

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



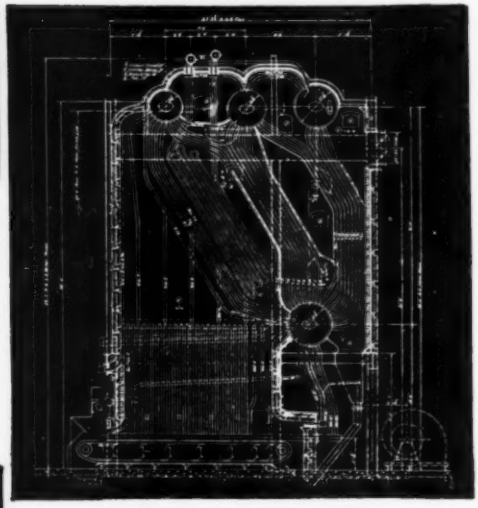
Quick Steaming at all Ratings!



Carry high overloads
with high efficiency

SPECIFY **Vogt**

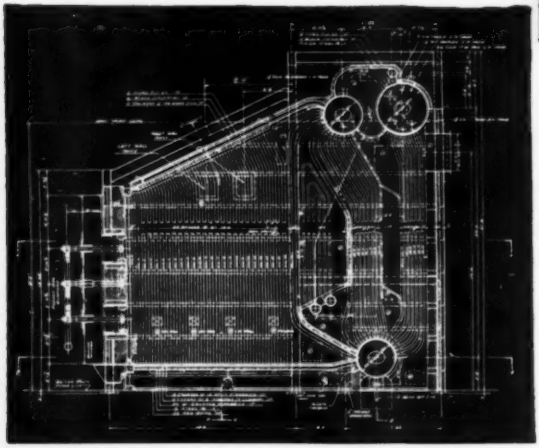
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

The Upjohn Co., Portage Road Plant, Kalamazoo, Mich. • *The Austin Company—Engineers and Builders*

UPJOHN'S MAMMOTH NEW PLANT

equipped for clean air by AAF!

THE COMPLETION of Upjohn's superb new plant means better health . . . more active lives for millions of Americans. Here, no expense or engineering talent was spared to obtain the most modern facilities for controlled pharmaceutical manufacturing. Since modern medicines . . . particularly anti-biotics and other sterile solutions . . . exact unusual requisites for sterility and plant hygiene even the air had to be hygienically *clean*.

American Air Filter products were selected to perform this service for the entire plant. Nine distinct types of AAF air filters and dynamic precipitators were used to supply clean air to the many operations and control the dust created by some of them. Though the problems involved both degree of air cleanliness and a wide spread in required volumes—AAF's complete line provided efficient and practical solutions in every instance.

For specific applications see the following pages . . .

American Air Filter

COMPANY, INC.

215 Central Ave., Louisville 8, Ky. • In Canada: Darling Bros., Ltd. Montreal, P. Q.

®AAF

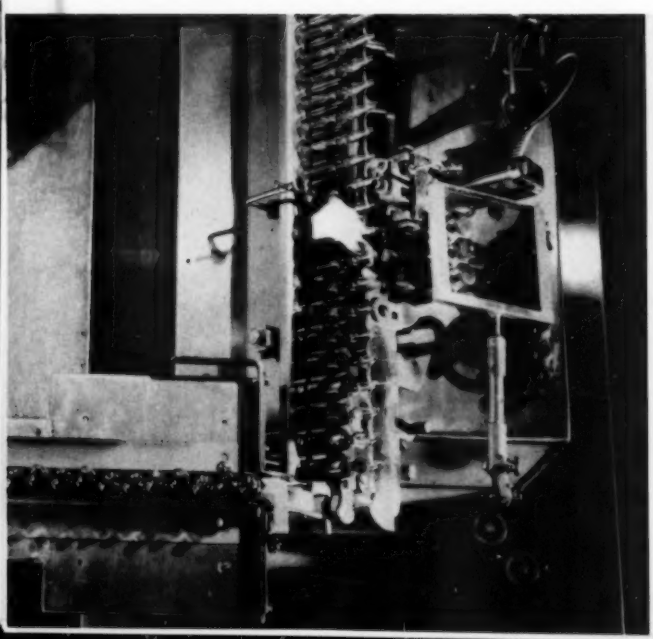
91 AAF UNITS

Supply More Than 1,000,000 c.f.m. . . . of Clean Air

MODERN pharmaceutical manufacturing creates highly diversified problems of air care. These range from maintaining sterile laboratory conditions to eliminating dust in maintenance shops. Illustrated are a few operations at the new Portage Road plant serviced by several types of AAF air filtering products. Upjohn's selection was based on their many years of experience with American Air Filter equipment.

AIR HYGIENE PROBLEMS

solved by nine types of AAF products

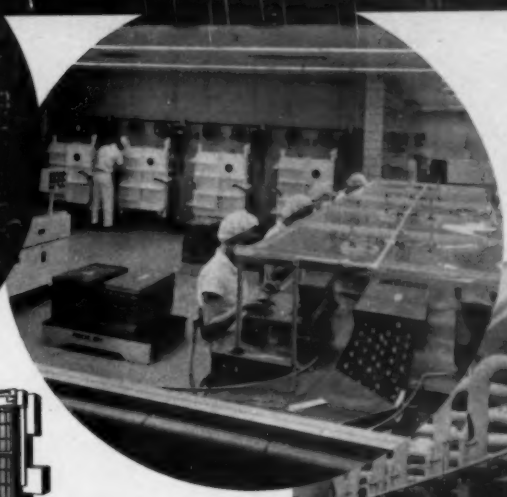


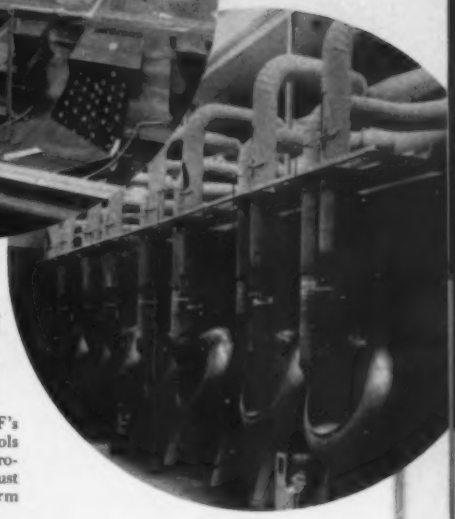
FILTER TYPES AND CAPACITIES

Upjohn Portage Road Plant

TYPE	NO. OF UNITS	TOTAL CAPACITIES cfm
AAF Electro-Matic	7	83,850
AAF Electro-Airmat	1	2,000
AAF Electro-PL	1	2,000
AAF Multi-Duty	53	830,570
AAF Multi-Panel	1	15,000
AAF Roto-Clone Type D	4	19,470
AAF Roto-Clone Type W	23	96,920
AAF Dust Box	1	1,200
TOTAL	91	1,051,010

AAF's Amer-glas disposable filter is used extensively throughout the plant.





● Bacterial filtration processes require exceptionally sterile conditions. Here, AAF's Electro-Matic supplies *super-clean* air by highest cleaning efficiency.

● Freeze Dry Area. Another operation requiring highly sterile conditions, as seen by visitors through observation panels. Again Electro-Matics supply the *super-clean* air required.

● Coating Pan battery. AAF's Type W Roto-Clone controls this dust source. These hydrostatic precipitators collect dust and store it in sludge form within self-contained units.

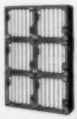
Upjohn's new Portage Road plant occupies approximately 33.2 acres of floor space. Main manufacturing building is 875 feet wide and 1120 feet long.

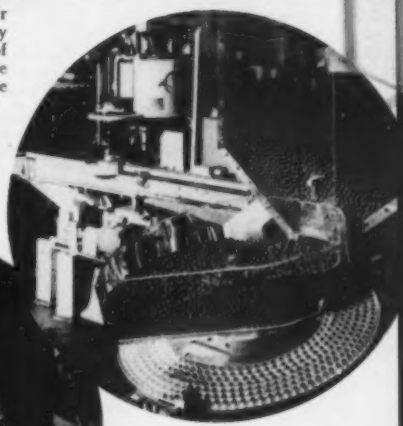
Antibiotics building at far right.

● Counting and Packaging. Air for this operation is filtered by AAF's Multi-Duty. A total of fifty-three Multi-Duty units are installed at the new Portage Road plant.

● Spray Drying. AAF's PL-24 and Amer-glas filters make an efficient team to eliminate airborne particles.

● Conveyors and transfer points. American Air Filter's Type W Roto-Clones provide complete collection of finely divided material at the source.





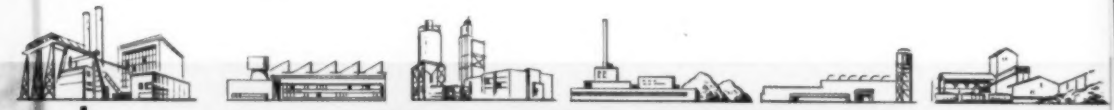
today's best buy is better air!

THERE IS ONLY ONE COMPLETE LINE OF AIR CLEANING EQUIPMENT...AAF!

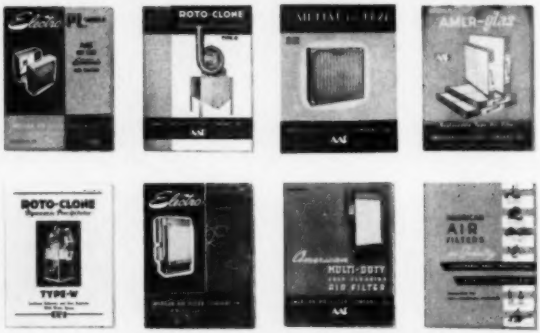
For thirty years American Air Filter has pioneered air filtration and dust control. Today its highly diversified products serve industry and commerce throughout the world.

AAF's engineering research in the control of air pollution is continually developing new methods, new products and solutions to new problems. The engineering staff is recognized as having the outstanding experience available in this field. If *you* have a problem requiring *clean air* call your AAF representative. He will provide a practical solution.

PHARMACEUTICALS • TEXTILE MILLS • DEPARTMENT STORES • HOTELS • BANKS • TRANSPORTATION
FOUNDRYS • METAL WORKING • CHEMICALS • PAPER MILLS • INDUSTRIAL FINISHING • MINING



These are a few of many AAF Engineering Bulletins covering all phases of air cleaning and the complete line of AAF products. Bulletins will be mailed on written request.

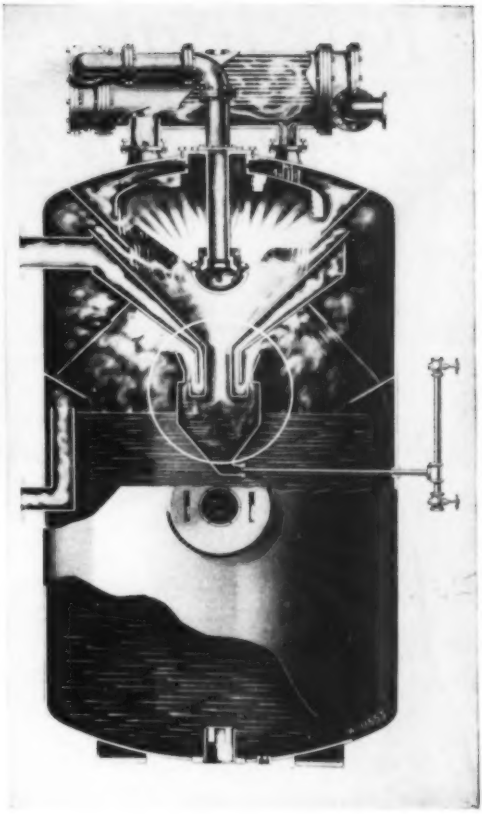


®AAF

American Air Filter

COMPANY, INC.

215 Central Avenue, Louisville 8, Ky. • In Canada: Darling Brothers, Ltd., Montreal, P. Q.



Hard scale, formed on the trays of deaerating evaporator preheaters, is no longer the big problem it used to be.

In a large central station (name on request), the preheaters had to be cleaned every three weeks, and the units were completely shut down at that time from eight to ten hours.

Then Worthington steam-jet deaerators were installed—with a "blowdown" head designed by Worthington engineers. This special head allows the operator to remove harmful deposits at regular intervals *while the unit continues in service*. It also provides for simple and speedy acid cleaning of critical parts, when necessary, without even opening an access door or removing any parts from the unit.

Compare The "Time-Outs"

The Worthington unit, given a short blowdown once each shift, stays in continuous operation with maximum deaeration for periods of at least 8 months. When the acid treatment is given at the end of that period, the job is finished in under three hours.

Compare this with the former record. *Then*—8 to 10 hours outage every three weeks and labor by a *crew* of men. Now—with Worthington's blowdown head—operation uninterrupted during regular short blowdown, with a shutdown for acid cleaning only once in almost a year, requiring only one man and three hours!

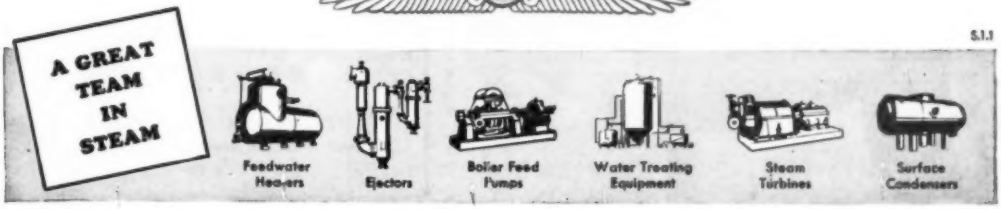
Worthington Makes Deaerating Equipment News

Developments like this, applicable to any deaerators operating under conditions of scaling, are typical of Worthington's engineering firsts in water treating and deaerating equipment.

Worthington manufactures all of the equipment needed in a complete water treating installation. For further information on why *there's more worth in Worthington*, address Worthington Pump and Machinery Corporation, Steam Power Div., Harrison, N. J.

WORTHINGTON

S.1.1



"For high dust collection efficiency CONSIDER THESE FACTS!"

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

OTHER APPLICATIONS

Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

STOP RUST WITH RUST-OLEUM

Why let rust—the most destructive enemy of American [illegible] —rob you of [illegible], hard-to-replace machines, tanks, stacks, fences, pipe, metal sash, fire escapes, and other valuable equipment?

Use RUST-OLEUM in your plant to protect your property. For 25 years RUST-OLEUM has proved its capacity to stop rust for many nationally known manufacturers. Its tough, pliable, rust-resisting film gives excellent protection that prevents rust losses under many difficult rust-producing conditions—salt air, dampness, industrial fumes, and general weathering.

RUST-OLEUM can be applied *even* over rusted surfaces. It is not necessary to remove all the rust. Just remove scale and loose rust by [illegible] and wire brushes. You save time and labor on maintenance because no chemical precleaning or sand blasting is usually required.

A qualified RUST-OLEUM specialist will be glad to [illegible] your rust problems and help you develop a program of plant-wide rust control to defer many costly replacements — to conserve the available supply of new metal for national defense.

Industrial Distributors in principal cities of the United States and Canada carry complete stocks for immediate delivery. Plan your needs—order *now!* See our complete catalog in *Sweet's* which also tells the nearest source of supply. Or, write on your company letterhead for full information.

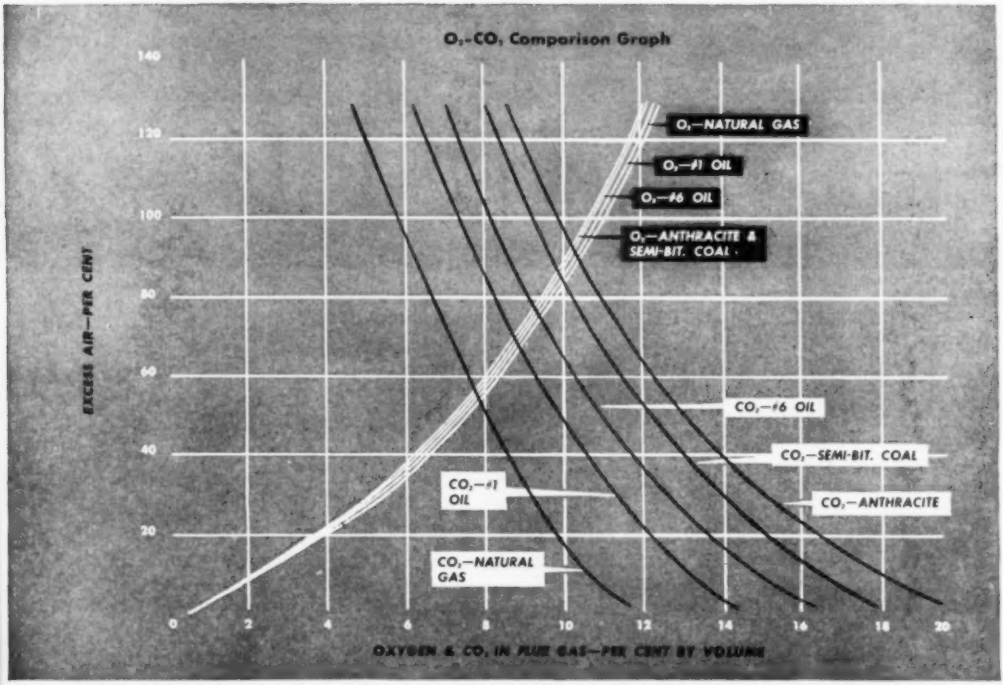
Available in many COLORS aluminum and white

Beautifies as it Protects

"RIGID ECONOMY, MON!"

RUST-OLEUM CORPORATION
2473 Oakton Street, Evanston, Illinois

How to burn Multiple Fuels efficiently



Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to CO_2 and O_2 in the flue gas of five common fuels. While the O_2 curves nearly coincide (especially in the important 30% excess air range) the CO_2 curves diverge widely.

Large Savings Possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

They purchased a Hays Magno-Therm Oxygen Recorder, and immediately found that their boiler operation was so inefficient that the pen would not stay on the 0-10% chart. However, by operating with reference to the O_2 recorder they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

With the Hays Magno-Therm Oxygen Recorder you get:

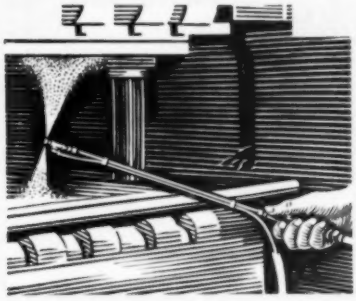
Continuous, highly accurate indication and recording.
Complete compensation for temperature and pressure effects.
Freedom from chemicals or hazardous fuel burning in the analyzing process.
Swift, sure electronic operation.

If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this O_2-CO_2 Comparison Graph as well as Hays Bulletin 50-829—describing the Magno-Therm Oxygen Recorder. Write for this free information.

THE HAYS CORPORATION
MICHIGAN CITY 2, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

NO SMOKE... NO FUMES
in Hot Forging with...
"dag" Colloidal Graphite



"Dag" colloidal graphite dispersed in water eliminates smoke and fumes in hot forging operations . . . greatly improves working conditions. The lubricating properties of colloidal graphite are superior, too, giving increased production . . . reduced die wear . . . better finish . . . and usually a saving in steel stock.

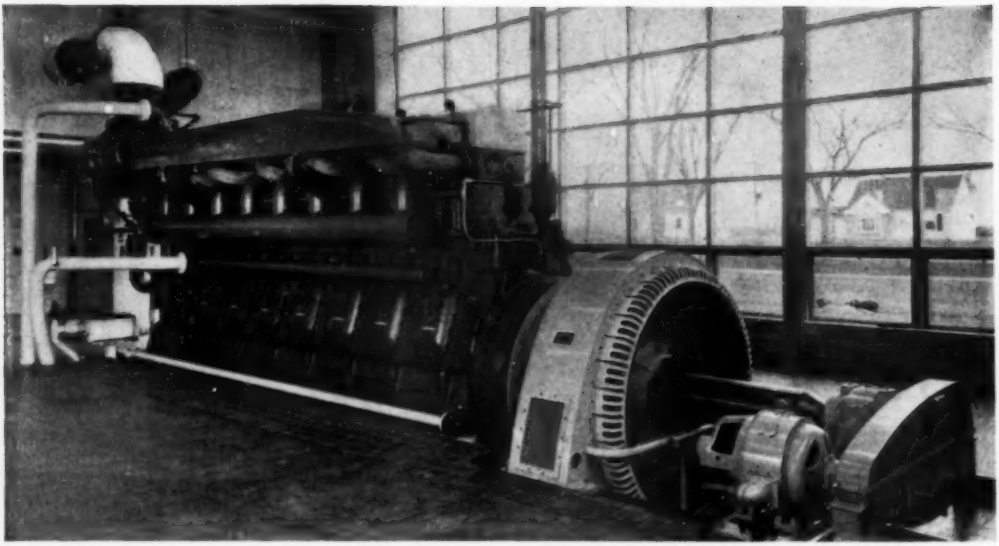
The uses of **"dag"** colloidal graphite for hot forging operations are fully explained in a specially prepared article entitled "Forging Die Lubrication". Copies are available without obligation. Write today to Acheson Colloids Corporation, Port Huron, Michigan, for Bulletin #750-17G.

dag
DISPERSIONS®

Acheson Colloids Corporation

Port Huron, Mich.

...also Acheson Colloids Limited, London, England



Typical Worthington supercharged engine-generator unit.

Makes money when the load is low Makes more as the load grows

You take care of the present and future *both* when you put your electric power generation in the hands of a Worthington 4-cycle super-charged Diesel engine.

Records show that such an engine, even when operating at a low load factor, is economical and maintains its economical performance as the load increases through the years.

For example: a Worthington 1500-hp supercharged engine at 40% load produces more kw-hrs per gallon of fuel than a 1000-hp naturally-aspirated engine at 60% load factor.

So it's cheaper to install a 1500 hp-engine today than to install a 1,000 hp-engine today and a 500 hp-engine later.

When you buy a Worthington 4-cycle supercharged engine, you benefit, too, from the longest experience of any manufacturer with this type of engine. For *any* engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

If gas or any combination of gas and oil offer fuel economies, consider Worthington gas or dual fuel engines. Only Worthington offers such exclusives as dual plunger pumps, gas micrometering valves for each cylinder, and thermal air controls—all built to give optimum performance for the fuel used.

For further details of the dependable, economical Diesel performance that proves *there's more worth in Worthington*, contact Worthington Pump and Machinery Corporation, Engine Division, Buffalo 5, New York.

WORTHINGTON

E.1.3

ECONOMICAL CONTINUOUS POWER
Diesel Engines, 150 to 2,640 hp . . .
Gas Engines, 190 to 2,880 hp . . .
Dual Fuel Engines, 345 to 2,640 hp.

WORTHINGTON-BUILT AUXILIARIES

Balanced Angle Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative-Type Engine Water Cooler

Bring them down with these DAYTON Cog-Belt* "teeth"

- 40% more h.p. per belt
- fewer belts
- fewer pulley grooves
- longer belt life

Switch to premium Dayton Cog-Belts and watch the cost of power transmission come tumbling down. Original cost is less. 5 Dayton Cog-Belts do the work of 7 ordinary V-Belts.

You save drive space. Cog-Belts let you use up to 25% shorter center-to-center pulley distances.

Cogs are the *only* V-Belts scientifically built to bend, like your finger. They withstand flexing and compression strains better, run cooler, last longer.

To get shut of V-Belt troubles for the duration, to save money and drive space, give your Dayton Distributor the "high-sign" of better V-Belt power transmission: the arched finger that means Dayton Cog-Belts and important savings!

COGS FIX FLATS!

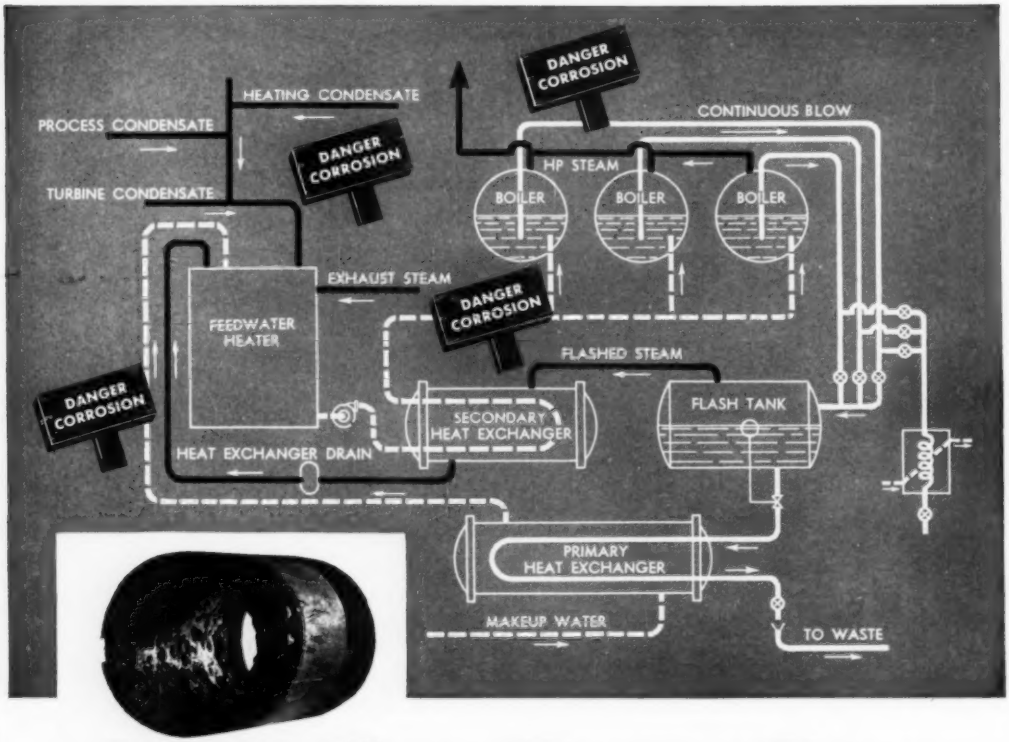
Dayton Cog-Belts converted a compressor drive in a railroad shop, from a flat drive that averaged 6 breakdowns a year, to a trouble-free V-flat drive now going into its tenth year of service. Cogs need no special pulleys, grip so well they convert flat to V-flat with only one pulley change!

DAYTON RUBBER COMPANY • DAYTON 1, OHIO

V-Belts by Dayton Rubber

*T.M.

WORLD'S LARGEST MANUFACTURER OF V-BELTS



AVOID These Danger Signs with BIRD-ARCHER Amine Treatment

CORRODED condensate return lines lead to expensive pipe replacement and maintenance. As an added annoyance, the solid products of corrosion often plug return lines and fill traps. You can steer clear of these troubles by using the *effective, economical* Bird-Archer Amine Treatment.

HERE'S THE WAY THIS B-A TREATMENT WORKS

Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself.

HERE'S HOW THIS B-A TREATMENT SAVES MONEY

Raising the pH value of the condensate severely decreases maintenance costs by eliminating corrosion. These savings may more than offset the amount of treatment required to provide protection for your equipment.

NEW BULLETIN gives full details on the Bird-Archer Amine Treatment. . . . contains case histories that prove its successful application in many plants. *Write for your copy today.*

BA-154

WHAT AMINES ARE

Amines are members of a class of chemical compounds in which one or more hydrogen atoms of the ammonia molecule are substituted by an organic group. Some of the simpler types are soluble and volatilize from boiler waters. The alkalinity of the amines is an inherent property and does not result from decomposition. *No free ammonia is released.* In the concentrations necessary for protection of condensate systems, amines are harmless to non-ferrous metals, non-toxic and are completely stable at temperatures approximating 675F.

BIRD-ARCHER WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO
IN CANADA: The Bird-Archer Co., Limited, 503 McGill Building, Montreal
IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 291, Mexico, D. F.

are you spending $5664

TO DO A $1417 JOB?

A Chicago plant* was! Oil consumption for their 5 high speed machines ran to $5664 a year . . . yet machine break-downs and bearing replacements were frequent . . . stock spoilage and rejects were high—until they made an important 30 day lubrication test.

This test involved the installation of an *Alemite Centralized Lubrication System* on a single mammoth machine. After a month of daily cost checks and comparisons, the system was installed on all five other machines in the plant at a total cost of only $2471. Since that time, there has not been a single break-down or bearing loss, stock spoilage and rejects have been greatly reduced, and lubricant cost has been cut to $1417. Net savings from this company's smart investment: $4247 annually. The net result: more production gained from each machine, marked product improvement, increased customer satisfaction!

Call Your Alemite Lubrication Engineer

No matter what size or type of plant you operate, Alemite can show you dozens of ways to save through the more efficient handling of petroleum products. Call your local Alemite Industrial Distributor now or send for the free booklet "11 Ways to Cut Production Costs." Simply attach the coupon below to your letterhead. Dept. M-71, 1850 Diversey Parkway, Chicago 14, Illinois.

*Name on request.

ALEMITE

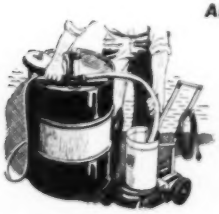
REG. U.S. PAT. OFF.

MEANS EVERYTHING FOR LUBRICATION

1. Methods 2. Lubricants 3. Equipment

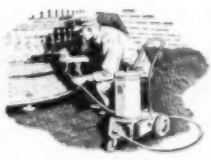
Another Product of Stewart-Warner

Alemite Cuts Costs 3 Ways



1. In transferring lubricants . . . cuts man hours 63⅓ for every 100 pounds transferred. No mess, no contamination.

2. In loading grease guns . . . saves 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. In applying lubricants . . . saves up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

FREE! Valuable booklet—
"11 Ways to Cut Production Cost"

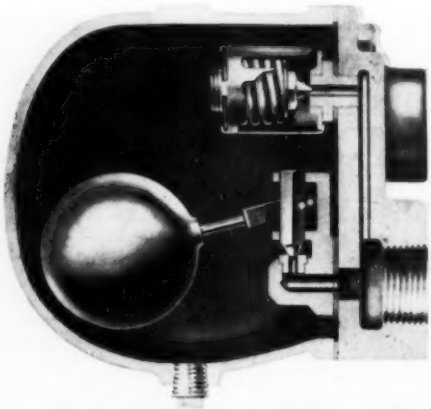
Simply attach this coupon to your letterhead and we'll include facts on the new Alemite Oil-Mist System, too—OIL-MIST atomizes oil into mist, circulates it to bearings under pressure. Increases life of bearings as much as 17½ times.

ALEMITE, Dept. M-71
1850 Diversey Parkway, Chicago 14, Ill.

Name .....

Company .....

City ..... State .....

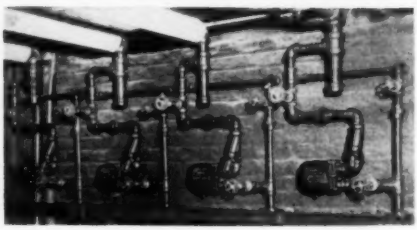


SARCO

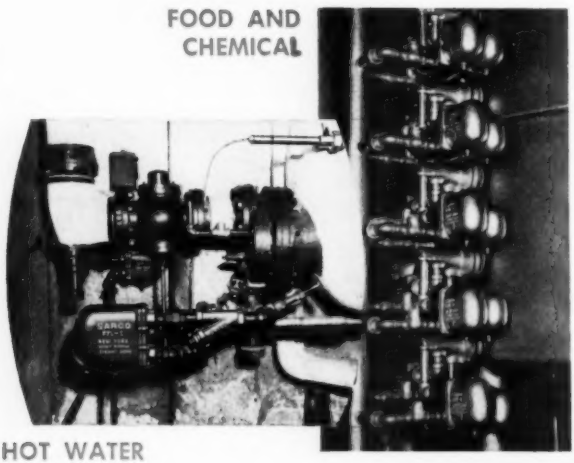
FLOAT-THERMOSTATIC STEAM TRAP

For Continuous Condensate Removal

HEATING MAINS



FOOD AND CHEMICAL



HOT WATER

Here is the trap that is used by the thousands for heating coils, mains and continuous process operations. The built-in automatic thermostatic by-pass takes care of all air and gases without steam waste.

The top illustration shows a bank of Sarco FT traps dripping the ends of mains in a large office building. At the left is shown a typical installation. In the soap and food industries, in two Chicago plants, a few Sarco FT's made a million dollars worth of equipment operative where three other types of traps had failed.

The controlled hot water hook-up at the lower left is another example. The ball float in the FT trap allows continuous discharge without shock to temperature controls. Ask for Catalog No. 450.

316

SARCO SAVES STEAM

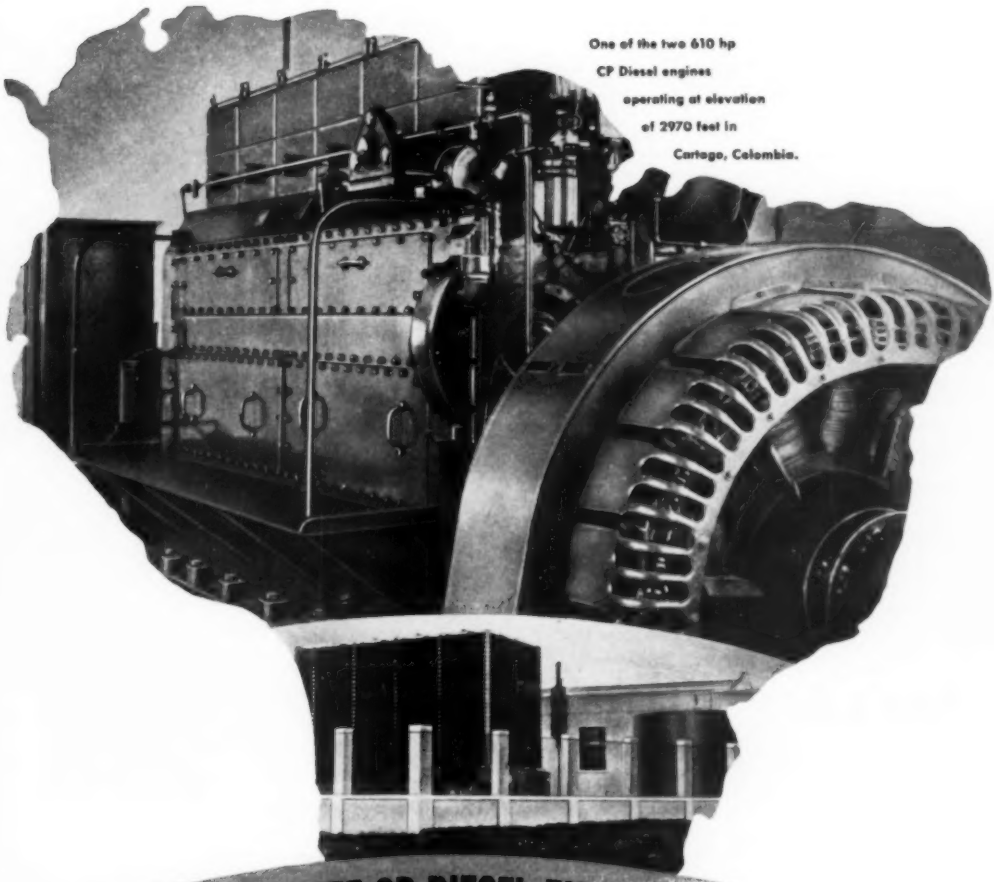
SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT



One of the two 610 hp CP Diesel engines operating at elevation of 2970 feet in Cartago, Colombia.

ANOTHER COMPLETE CP DIESEL ENGINE INSTALLATION IN SOUTH AMERICA

For its new municipal power plant, the City of Cartago, Colombia, after careful consideration, selected CP Diesel engine equipment consisting of two 610 hp, 514 rpm units, for driving 400 kw generators.

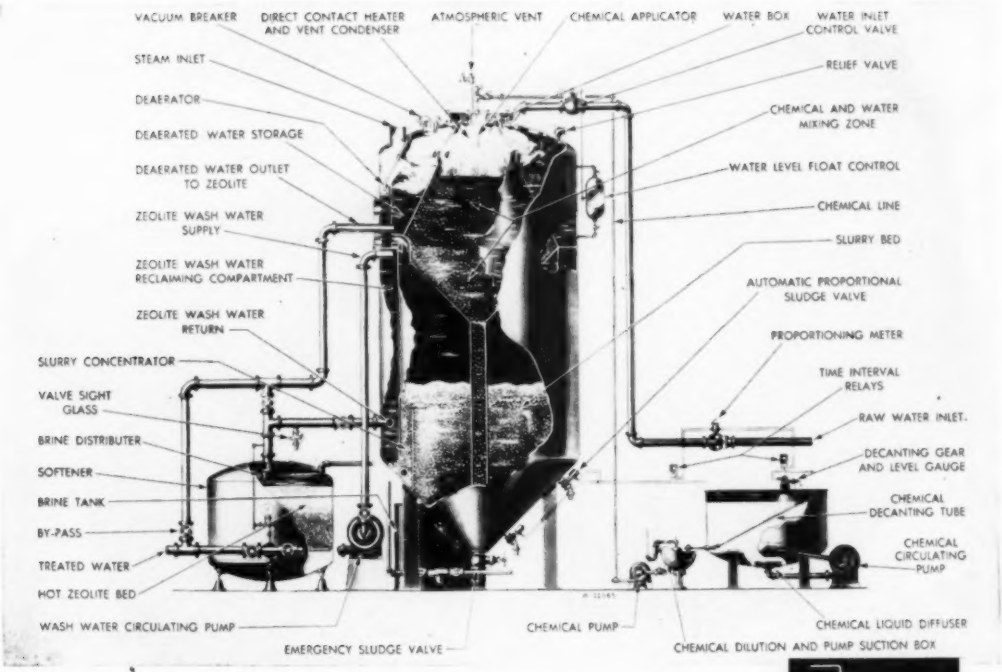
The entire plant, including building, accessories and provision for future expansion, was designed, engineered and erected as a single project, and then turned over to the City of Cartago ready for operation.

This is a typical example of how CP service can relieve a customer of all the technical problems and details involved in the design and installation of a complete Diesel-electric power plant.

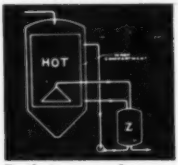
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Here's how to make water softening a soft job for you



You have less to do . . . to worry about . . . to pay for—when you use Worthington's revolutionary Hot-Z Slurry-Type Deaerating Water Softener.

It combines all the best features of Hot Process and Zeolite, plus these Worthington-originated features:

No more scaling trouble. Direct-contact vent condenser eliminates scaling trouble experienced with old-fashioned shell-and-tube types.

Supervision reduced. Concentrated sludge is removed automatically and proportionately to water volume.

Assures uniformity. Hydraulic chemical mixer assures uniformity of chemical strength. Also saves space.

Easier cleaning of valve-type wash water sight glass.

Better deaeration. Steam-jet deaeration is simpler, gives better efficiency—removes oxygen to .005 cc per litre.

Independent backwash system. Built-in annular wash water compartment provides clear hot water for backwashing and reclaims it without affecting operating velocities in treating zone. This feature not only pays off in systems employing filters, but also is ideal for backwashing the hot zeolite.

You also save because Worthington Hot-Z Systems operate on low-priced lime and salt. The average installation saves enough in chemical costs to pay for itself in 3 years!

Get all the facts!

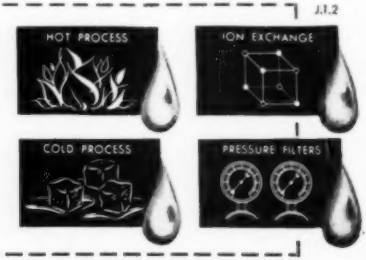
It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find *there's more worth in Worthington.* Worthington Pump and Machinery Corporation, Water Treating Section, Dunnellen, N. J.

J.1.2

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



13 YEAR TORTURE TEST
...STILL LIKE NEW!

QUAKER PACKINGS

Provide Positive Seal . . . Retain Flexibility Despite High Temperatures and Pressures

Here's a seat gasket cut from Ebonite Sheet Packing that rolled up thirteen years of trouble-free service on a pop-off pressure relief valve in a southern plant . . . withstanding high temperatures and pressures . . . eliminating leaks and shutdown time...assuring absolute safety. Only extensive changes requiring different sized gaskets made it necessary to replace this gasket at all!

Performance like this is made possible because of Ebonite's remarkable leak-proof characteristics and the fact that it will not carbonize, melt or become hard. That's why Ebonite is ideal for high pressure joints and flanges; for use with superheated steam, ammonia, brine, air, oils, acids, caustics, gases, hot or cold water.

For all your requirements—whether packings or belting for conveying materials . . . flat or V-belts for driving steam engines, steam turbines or electric motors . . . hose for flushing, suction, cleaning or fire fighting purposes—see your Quaker distributor, or write direct to us.

HOSE FOR RUGGED WEAR

Hose for air, steam, water, oil, gas or paints, Quaker makes it to fit the needs of the Chemical Industry. Each is pre-tested for peak performance.

BELTING FOR MAXIMUM HORSEPOWER

Flat belts or V-belts, Quaker has the one to fit the drive . . . to transmit maximum horsepower at the lowest operating cost . . . all pre-tested to assure peak performance.

QUAKER RUBBER CORPORATION • PHILADELPHIA 24, PA.

DIVISION OF H. K. PORTER COMPANY, INC. • Offices and Branches in Principal Cities

QUAKER RUBBER PRODUCTS *custom made for every industrial use*

puts the HEAT on heat exchangers

By changing to Yarway Impulse Steam Traps, an oil refinery reports much hotter steam in their heat exchangers **—plus two other important extras:**

(1) They were able to operate the plant with 6 boilers instead of the 8 formerly required.

(2) Three men formerly required to service old-type traps can now be used for productive work.

Significant sidelight—these Yarway traps are operating under severe conditions, many outdoors with temperatures often below zero.

Plant after plant is standardizing on Yarway Impulse Steam Traps because Yarways are designed to deliver the most premium B.T.U.'s at top temperatures into your process or product. **They get equipment hotter, sooner ... and keep it hot.**

Other reasons—small size, easy installation, good for all pressures, only one moving part, low maintenance, low price.

Buy your Yarway Impulse Steam Traps from the nearest of 216 distributors. For name, write us.

ACTUAL SIZE ¼" YARWAY STEAM TRAP

YARNALL-WARING COMPANY
109 Mermaid Ave., Philadelphia 18, Pa.

FREE OFFER. Don't take our word for it. Test Yarway's advantages in your own plant, without cost or obligation. Drop us a card or letter—a trial trap will be delivered promptly.

YARWAY the steam trap
designed with more production in mind

QUAKER custom made for every industrial use

INDUSTRIAL POWER

July, 1951 Vol. 41, No. 1

Relocation of power plant from congested manufacturing area to the more spacious site at the right has improved coal and ash handling. It will eventually house all steam equipment

MONSANTO'S SMOKELESS BOILER OPERATION RESULT OF PLANNING

Excellent example of the cooperation of industry with civic authorities in reducing urban smoke and fly ash nuisance. New 200,000 lb per hr traveling grate spreader stoker fired boiler in the John F. Queeny Plant of the Monsanto Chemical Co. more than complies with the rigid smoke abatement and fly ash ordinances of St. Louis, Mo.

WILLIAM C. DURNING,
Supt. of Utilities,
John F. Queeny Plant

GEORGE OSTROOT JR.,
Power Engineer,
General Engineering Dept.

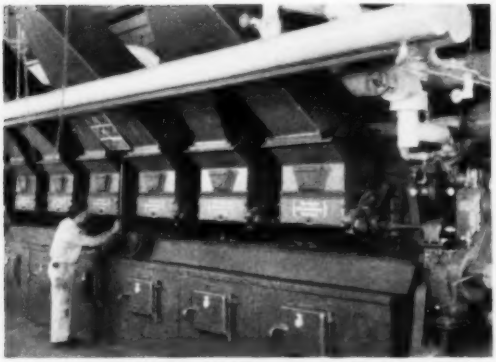
FOR many years a leader in St. Louis civic affairs Monsanto Chemical Company's voice was loud amid the clamoring for rigid smoke and fly ash ordinances that, since their enactments, have reduced St. Louis air pollution to a remarkable degree. Thus when the planning and engineering of a new 200,000 lb per hr boiler began, the power engineers and designers were under great pressure, not only from the municipal authorities, but also from within Monsanto, to produce a boiler installation for operation with the minimum stack discharge and, coincidentally, with maximum reliability. Fuel-burning efficiency was given third ranking behind stack discharge and reliability.

In this problem confronting the engineers, the selection of the type of fuel burning equipment was considered to be of prime importance. The size of the boiler and the use of Southern Illinois bituminous coal eliminated the chain grate and underfeed stokers, so the choice fell between pulverizers and spreader stokers. The selection of the traveling grate spreader stoker was based primarily upon two issues, fly ash collecting equipment and fly ash disposal. In order to limit stack emission to 0.85 lb fly ash per 1000 lb flue gas as required by the St. Louis ordinance, collectors for a pulverized coal fired boiler require much more elaborate and expensive collecting equipment than does a spreader stoker fired boiler.

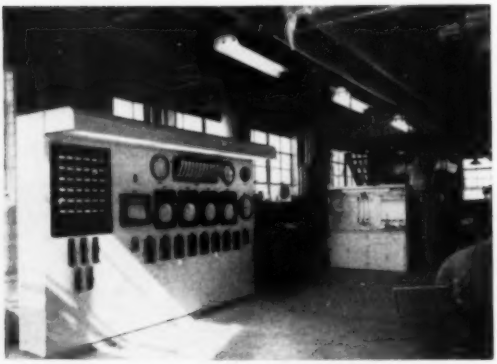
Furthermore, the fly ash disposal problem is non-existent with the spreader stoker because the ash is reinjected to the furnace and is fused on the grate into larger pieces of ash that can be handled by a pneumatic ash conveying system and satisfactorily wetted in a dustless unloader when being discharged to railroad cars or trucks from the ash silo.

The various features designed to minimize stack emission that were incorporated into the boiler installation are as follows:

1. A high draft loss, cyclone type mechanical dust collector was installed between the air preheater and the in-



Stoker has split grate arrangement—one section is steam turbine driven, the other is operated by electrical motor



Operating panel gives a good picture of boiler performance. Chemical lab, in background, aids in checking boiler water

duced draft fans. By actual test collection efficiency is in excess of 90 per cent.

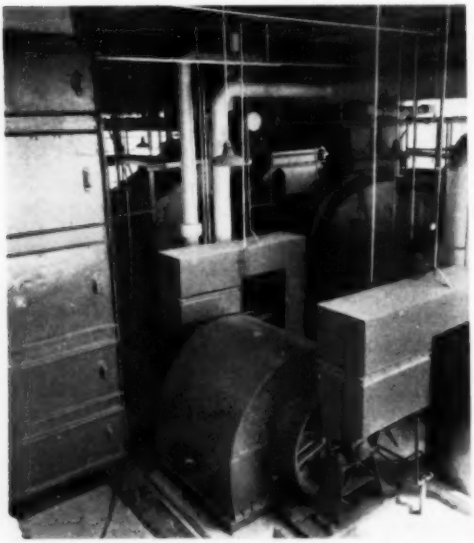
2. High collection efficiency in the collector requires a high draft loss. In order to maintain a high draft loss at partial loads, a flue gas recirculating duct from the induced draft fan discharge to the dust collector inlet was installed. A damper operated by a regulator sensitive to draft loss across the collector automatically controls the amount of recirculation to maintain the minimum preset draft loss across the collector.

3. Overfire air system is tied into the combustion control system, and amount of overfire or furnace turbulence air varies automatically with the boiler rating. Inasmuch as this new boiler carried the plant swings in steam demand, this control largely eliminates inefficiency at high load and smoke at low load, or the constant attention of a fireman to maintain efficient as well as smokeless operation at all loads.

4. In order to minimize smoking during load changes the combustion control system was so designed that coal feed would momentarily lag air flow on an increase in boiler load; during a decrease in boiler load, coal feed reduction would precede reduction in air flow.

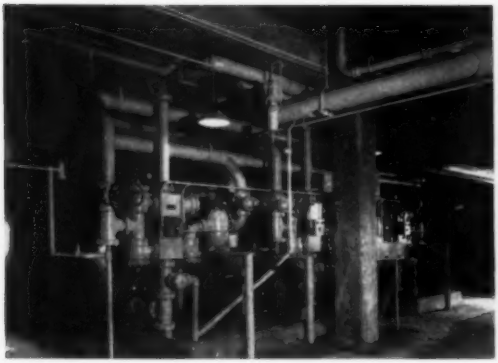
5. Another feature incorporated into the combustion control system consists of a coal feed limiting relay that acts to limit coal feed to air available for combustion. Normally this inoperative, but in the event of a major curtailment in air flow caused, for instance, by a fan failure, the relay will reduce the demand for coal, even at the expense of steam pressure, to the amount of air available to burn a given quantity of coal. Thus, during such emergencies, when steam pressure would fall anyway, heavy smoke will be minimized, if not eliminated.

6. A constant record and indication of smoke density in the base of the stack is kept by a photo-electric cell type smoke density meter. The indicator is located on the boiler control

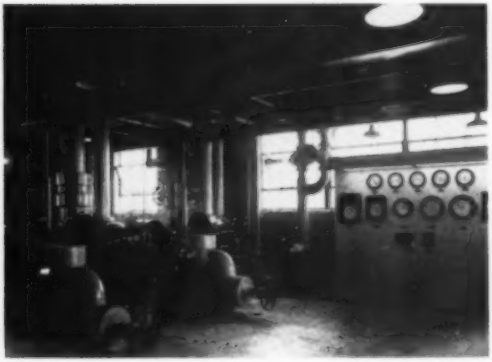


FD fan, foreground, is equipped with constant speed motor and vane control to limit air supply. Twin ID fans, background, are driven by a steam turbine and electrical motor

Ash and fly ash hopper discharge into a pneumatic conveying system by gravity. It is then carried to an outside storage silo, wetted, removed and trucked away daily



Feedwater softening tanks are connected in parallel, with two operating, and the third acting as a constant standby



Steam turbine driven feedwater pumps also operate in parallel, and each has a capacity to supply full boiler needs

panel for handy reference by a fireman making adjustments to the combustion control system. The lens in the actuating element of the meter is cleaned each shift to insure accurate indcation by the instrument.

Notwithstanding the fact that provisions to minimize stack emission were very much emphasized, the entire boiler installation was carefully engineered in accordance with the standards of industrial boiler plants in general and Monsanto in particular.

Although designed for operation at 650 psi, 750 F TT, initial operating conditions are 125 psi, 450 F. The maximum continuous capacity of the boiler is 200,000 lb per hr with a three hour peak of 220,000 lb per hr. Both economizer and air preheater are installed, with final exit gas temperature of 297 F at 100 per cent rating.

The stoker is a traveling grate spreader stoker with six feeders. The grate is divided into two sections, each driven by a motor with standby turbines for use during power failure. Because of the relationship between the capacity of this boiler and the total plant steam demand all critical drives in the boiler plant — fans, feed pumps, instrument air compressor and cinder return and furnace turbulence systems, in addition to the stokers — are furnished with standby turbines for such an eventuality.

Of particular interest in this new installation is the mechanical draft equipment. By the expedient of installing two half-sized induced draft fans, each with single half-sized drivers, instead of one full-sized fan with full-sized dual drivers, the installed motor and turbine horsepower was halved. The forced draft fan equipment received the same treatment. Not only was a large reduction in capital investment and operating cost effected, but one fan alone in each of the sets can furnish draft and air for approximately 85 per cent of boiler rating. Incidentally, during the initial period of low-pressure operation all four fans were installed with turbine drivers to satisfy station heat balance requirements.

Boiler feedwater is 100 per cent makeup. Water treatment consists of softening in sodium zeolite softeners, followed by oxygen removal in the deaerating heater and by injecting sodium sulphite into the suction of the feed pumps, and concluded by pumping sodium metaphosphate and caustic into the boiler drum.

Coal, after being dumped into the track hopper from either cars or trucks, is transferred by bulk-flow type conveyers to a belt conveyer discharging into the 600 ton capacity overhead coal bunker. Stoker ash and siftings from the stoker windbox are removed to an ash silo by a pneumatic ash conveying system.

The boiler, stoker and auxiliary equipment have performed very satisfactorily in operation, and careful planning and attention to details has resulted in a stack discharge well within the limits required by St. Louis city ordinances.

PRINCIPAL EQUIPMENT AT JOHN F. QUEENY POWER PLANT

Boiler	Foster Wheeler Corp.
Stoker	Detroit Stoker Co.
Feedwater treatment	Infilco, Inc.
Feedwater pump	Ingersoll-Rand Co.
Feedwater pump turbine	Elliott Co.
Deaerator	Worthington Pump and Machinery Corp.
Induced draft fan	American Blower Corp.
Induced draft fan turbine	Elliott Co.
Induced draft fan motor	Elliott Co.
Forced draft fan	American Blower Corp.
Forced draft fan turbine	Elliott Co.
Coal conveyer	Stephens-Adamson Mfg. Co.
Combustion control	Hagan Corp.
Coal meter	Bailey Meter Co.
Steam-flow air-flow system	Bailey Meter Co.
Feedwater control	Bailey Meter Co.
Ash handling	United Conveyor Corp.
Ash cyclone	Western Precipitation Corp.
Stoker drive	Link-Belt Co.
Stoker drive turbine	Carling Turbine Blower Co.
Stoker drive motor	The Louis Allis Co.
Air compressor instruments	Pennsylvania Pump & Compressor Co.
Air compressor motor	Reliance Electric & Engineering Co.
Phosphate pumps	% Proportioneers, Inc. %
Phosphate pump motor	Wagner Electric Corp.
Chemical pumps	Milton Roy Co.
Chemical pump motor	General Electric Co.
Hopper gate	Beaumont-Birch Co., Inc.
Draft gage	Republic Flow Meters Co.
Temperature recorder	Brown Instrument Co.
Smoke indicator recorder	Leeds & Northrup Co.
Over fire and injection air blower	Buffalo Forge Co.
Over fire and injection air blower motor	The Louis Allis Co.
Over fire and injection air blower turbine	Carling Turbine Blower Co.

Illumination levels of:

- 60-100 ft-c—Difficult seeing tasks with finest detail, continuity and precision involved
- 40-60 ft-c—Critical and prolonged work which involves fine detail and moderate contrasts
- 20-40 ft-c—Ordinary seeing tasks with normal detail and contrasts; intermittent work

Small parts assembly is a difficult, continuous seeing task. In the center, each luminaire contains four T-8 slimline lamps. Rows are on 10 ft centers at 19 ft height for 80 ft-c at 4¼ w per sq ft. Bay at right has 70 ft-c, 15 ft height

COMMON APPLICATIONS IN PLANT LIGHTING

These examples summarize the best engineering experience in producing good lighting conditions economically. They can be adapted for most requirements found in industry

PROPER LIGHTING involves many factors which must be modified by economic aspects to produce maximum visibility for lowest installation and maintenance cost. Experience has shown that most conditions fall into a few general classifications from which the plant engineer can choose a system for most industrial operations.

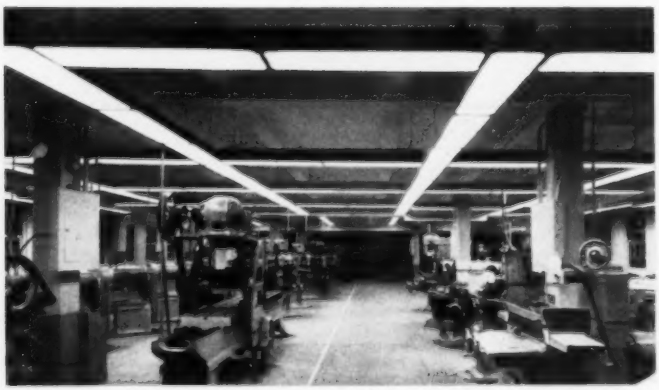
First step is determination of illumination required on the task. Highly skilled work or production requiring constant visual attention, or involving finest detail or poor contrast, require lighting in the 100 ft-c class. Normally operations in this group involve expensive parts or materials and elimination of operator fatigue more than justifies cost of the best possible illumination. Often a moderately high overall intensity is supplemented by local illumination in the immediate vicinity of the task.

Difficult and critical seeing tasks, such as those involving fine detail, long periods, ordinary bench work and assembly and machine shop work, indicate a level of the order of 50 ft-c. 30 ft-c is good for other operations on ordinary rough work with moderately fine detail, intermittent periods and normal contrasts.

Choice of the type of lamp, (fluorescent, mercury or filament) usually is based not only on characteristics of the light but on the economic balance between operating cost (efficiency) and maintenance cost.

Fluorescent lamps have become widely accepted in industry because their low surface brightness reduces glare. They are about three times as efficient as filament lamps, but can be designed only in relatively low wattages, and more lamps are required to maintain a given level of illumination. Against the increased installation and maintenance costs, then, are the lower operating costs and the fact that more lamps distributed over an area result in more uniform illumination. Coolness and color are often factors.

Fluorescents find applications in most classes of plants and at all heights up to 40 ft. The 85 w lamps and the slimlines give more light than the smaller 40 w tubes, allowing fewer lamps with reduced maintenance. Slimline lamps, which have no starters to require replacement, light instantly.



With a 9½ ft mounting height, the grid installation gives diffused illumination at 80 ft-c for fine work. Both the continuous and the cross rows are on 10 ft centers and, with two 40 w fluorescents per unit, use 4½ w per sq ft

Single lamp, low brightness units in troffer beam result in 50 ft-c of soft lighting and a finished ceiling. 40 w, T-17 tubes in rows 3 ft apart require 3½ w per sq ft

For high bay lighting at 50 ft-c, twin 1000 w filament lamps alternated with twin 400 w mercury units on 14x20 ft centers are most easily maintained at the 45 ft height

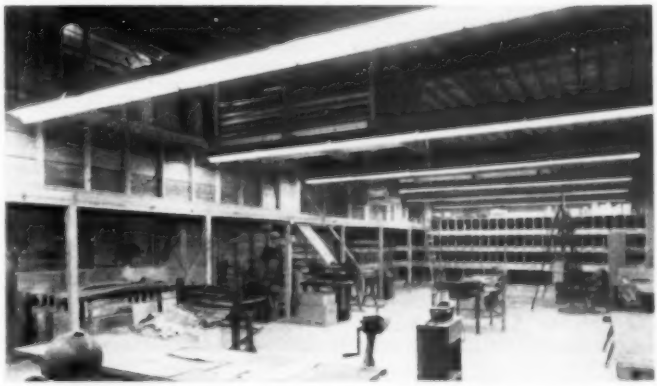
Fixtures for fluorescents are usually mounted in rows for intensities up to 60 ft-c as illustrated in the photographs. At higher levels of illumination, the grid-type installation on say, 10x13 ft centers at a 10 ft height, is the most practical answer.

Mercury lamps, a high intensity source, produce glare, and are most practical for high mounting (40 ft and above) where a concentrated source is not so objectionable and where maintenance requires maximum light per outlet. 400 w units are popular, although 3000 w bulbs, with as much light as fifty 40 w fluorescent or six 1000 w filament lamps, may be used.

The blue-green color of mercury lamps must be supplemented by the yellow-orange of the filament types to produce a cool white light with reasonable color rendition. Common practice is to use a 400 w mercury bulb with a 500 w or 750 w filament lamp, or in pairs with a 1000 w incandescent. This system insures light immediately after a power outage, even though the mercury lamps require several minutes to restrike. The combination is second only to mercury lamps alone in overall economy. High brightness makes well-designed fixtures necessary, with extra consideration required where shiny materials are handled.

Filament lamps, in spite of lower efficiency and higher operating costs, are still popular because of the small investment and easy maintenance. They are flexible in size, layout and operation. The concentrated source requires adequate shielding but allows the output to be accurately controlled. The 300 w reflector lamps reduce maintenance in dirty areas with only slightly higher lamp cost.

Courtesy of General Electric Co.



In a sheet metal shop, continuous rows of fluorescent units having two 40 w lamps each provide a level of 35 ft-c and a good example for a low bay area in light industry. Rows are 10 ft apart, 11½ ft high. Lighting load is 2 w per sq ft

On an 8x10 ft spacing, 15 ft above the floor, these 300 w filament lamps provide 30 ft-c in a foundry core room, at a load of 3¾ w per sq ft. Though inefficient, the filament type is low in first cost, and is also flexible and easily maintained

CYANAMID EQUIPMENT STANDARDS

Here is why and how American Cyanamid plants integrate the best engineering experience of separated units into a solid base for future company operations, designs and procedures

K. W. MAHEN, *Secretary of Standards Section, Central Engineering Dept., American Cyanamid Co.*

INDUSTRY is continually striving to find better equipment and methods for plants and processes. As quality of the design and procedure elements become evident, the poor are rejected and the best used again. When the worthwhile elements are put on paper, they become standards used by designers to avoid future, costly investigations for similar circumstances.

American Cyanamid plants throughout the country cooperate with the Central Engineering Department (C.E.D.) in producing needed standards. Aim of the C.E.D. is not to dictate exactly what should be done down to the last detail, but to act as a clearing house of proven procedures. Subjects standardized are listed in the table below.

Standards are issued only in those cases where the benefits are widespread rather than on subject material of purely local interest. They are intended for company-wide application and their use is generally mandatory, particularly where health and safety of personnel are involved. However, it is recognized that local conditions may require minor variations. Administrative procedures also allow for major departures.

The company does not expect standards to substitute for intelligent use of engineering principles, nor to freeze technical information into a static mold. All engineers are encouraged to take a keen interest in the dynamic development of new standards and necessary revisions in existing specifications.

New standards have their inception when the need is recognized. All available known data are gathered and edited, involving consultation with C.E.D. specialists who have spent many years on pertinent problems. Works of the technical societies are checked to avoid duplications and deviations whenever possible. A draft of the proposed standard is sent to all company personnel concerned and return comments are further edited, checked and circulated before the final standard is issued.

Materials and procedures standardization eliminates duplication of effort. Engineering and development work would otherwise be required in several departments to arrive at the same ultimate efficiency and minimum cost compatible to the job. To these savings should also be added the excess upkeep and running costs incurred in less efficient plant operation during the development period.

Inventories can be drastically reduced by standardization of materials, thereby saving carrying costs and building space. Carrying costs for maintenance and material stores are from 15 to 20%

STANDARDIZED SUBJECTS WITH EXAMPLES OF ITEMS INCLUDED

Architectural—Building layout and design, internal and external treatment, and equipment and utilities.

Civil—Surveys, sub-soil tests, site preparation, area drainage, railroad facilities, roads, sidewalks and fencing.

Structures—Wood, reinforced concrete, masonry and steel. Includes piling and foundations.

Electrical—Electrical distribution and control, including support and safety structures, enclosures, and communications systems.

Steam Power—Generation, distribution and utilization, including condensate collection and return systems.

Air Systems—Process and utility systems other than air conditioning. Includes compressing, distribution and control.

Instrumentation—Design, selection and application of instruments, controls, panel layouts and special piping and electrical systems.

Insulation—Design, selection, application of thermal and sound-proofing insulation, with supports, weatherproofing and protection.

Vessels—Tanks and towers for general storage and processes.

Water Systems—Storage, treatment, distribution, reuse, with cooling towers and spray ponds, for process, utility and fire protection.

Air Conditioning—Cleaning and conditioning for personnel comfort and processes as distinct from heating and ventilating systems below.

Heating and Ventilating—Equipment, distribution and control systems for factory, office and laboratory space.

Refrigeration—Equipment, distribution and control systems for process units, low temperature storage and ice making.

Dust Collection—Equipment, transport and control for separation, collection, recovery and disposal of industrial dusts.

Waste Disposal—Systems for the collection, treatment and disposal of sanitary and chemical wastes.

Material Handling—Equipment for transporting solid materials. Also equipment for packaging or canning finished products.

Machine Design—Design of special machines or elements and layout of machinery or equipment. Mechanical power transmission linkage systems; materials of construction and fabrication procedures.

Process Design—General application of unit processes to equipment, units and plants; flow sheets and design procedures.

Process Equipment—Design and selection of process equipment such as absorbers, granulators, furnaces, screens and precipitators.

of inventory value. Larger purchases of fewer items mean faster turnover and less storage space, record keeping and supervision.

Although stores and supplies are obviously necessary for operation, money invested in them shows no direct profit. Thus every dollar by which inventories can be reduced helps increase active production funds.

A reclamation department is maintained at the Linden plant and receives shipments of excess inventories and overstocked items. When these are not standard, they cannot be used in other plants at their full value. Rather, a high percentage must be written off in the final disposition.

Frequently a standard item will replace six or seven previously used and bring improved efficiency in the purchasing services. Better trade relations with suppliers, lower costs, improved deliveries and a better, over-all purchasing function result. Each item should be studied from the standpoint of cost, availability and interchangeability. Unnecessary restrictions only lead to increased costs and confusion.

C.E.D. standards are universal and, where feasible, general in type, defining minimum acceptable requirements. In addition, there are plant standards, prepared locally and determined by local conditions. Preference, however, is given to types of equipment having wide application. Standards are set up for products conforming to C.E.D. standards where possible.

Fig. 1 is a typical C.E.D. standard on the piping layout of a refrigeration system. All connections, valves, instruments and other features necessary to safe and efficient operation are shown. Other standards, as on symbols, insulation and supports, are, of course, involved in the final design and installation.

Taken from the section on machine design, Fig. 2 shows the standard safety limitations in the construction of safety guards for belt drives. Other standard sheets give methods of construction and materials.

The maintenance and construction department also has a group of procedure and specification standards which apply to the operations peculiar to this department. In general, they are written in four sections: (1) description of job and equipment; (2) responsibilities of the personnel issuing work orders, doing the work, cleaning up, and supplying and recovering equipment involved; (3) procedure, including personnel involved, in performing the work and (4) general information such as safety precautions. Responsibilities are thereby fixed, lost motions saved, salvable materials conserved and confusion avoided.

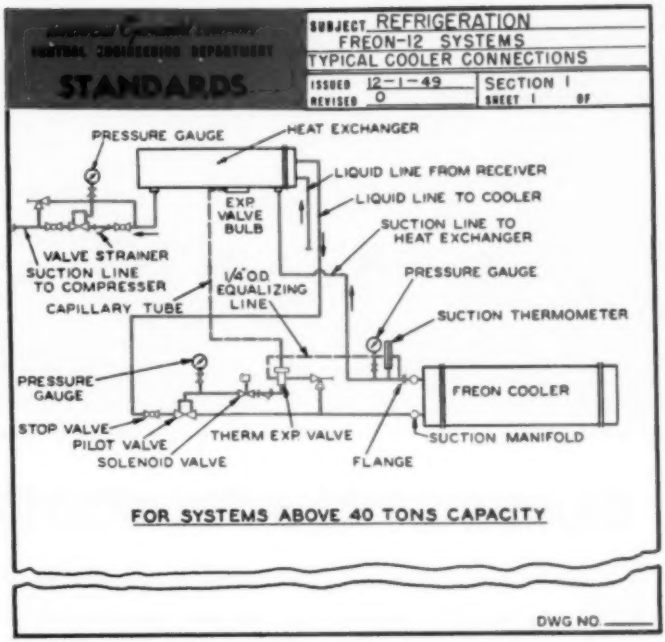


Fig. 1—Piping layout of refrigeration systems over 40 tons gives standard connections, valves and instruments. Make of components is specified when necessary

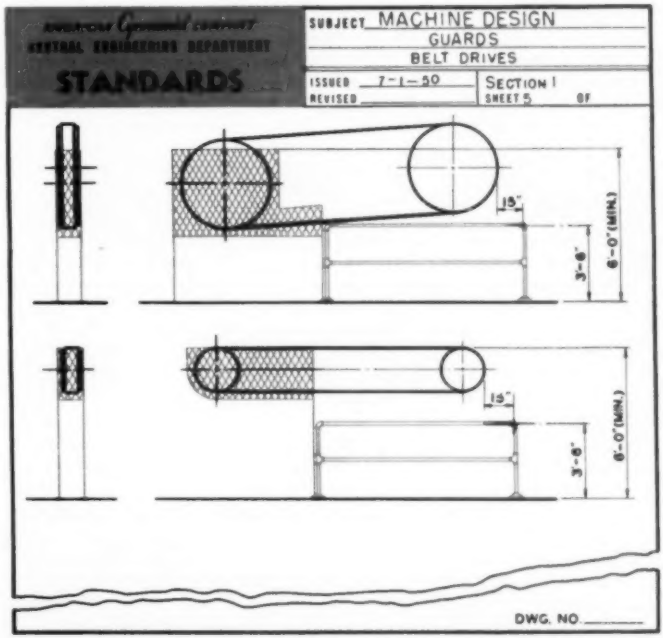


Fig. 2—This standard on guards for belt drives specifies minimum safe dimensions. Other sheets coordinate design and materials with construction of similar items

In June, The Upjohn Company formally opened America's largest pharmaceutical plant

UPJOHN'S MAMMOTH INDUSTRIAL BUILDING

Systems handle nearly 3,000,000 cfm. Air conditioning equipment is in truss area and basement, leaving main manufacturing space free for straight-line production

THE OPENING last month of The Upjohn Company's new pharmaceutical plant near Kalamazoo, Mich., marked the completion of a building program without precedent in the pharmaceutical industry.

The largest single construction project on record in the rapidly expanding field, it represents the results of nearly ten years of active study and planning and more than five years of actual design and construction work. Exhaustive studies into the relative merits and costs of expansion at and adjacent to the company's facilities downtown and at a completely new site were made by two consulting engineering organizations before the contract for design and construction of the new facilities was awarded to The Austin Company in 1946.

In the years that followed, management, engineering and production personnel at Upjohn and members of The Austin Company's Chicago district staff teamed in a working partnership with these objectives: (1) To provide the best obtainable accommodations for the manufacture of Upjohn products, present and future. (2) To insure maximum efficiency and economy consistent with the high quality of the company's products. (3) To provide facilities and conveniences that would conserve the health, time and energies of employees and would contribute to the enjoyment of their work.

The result has been the group of buildings illustrated on the opposite page. Every square foot of each building has been carefully designed for exceptional flexibility of usage and maintenance at minimum expense.

Except for antibiotics, which are produced in a multi-story structure required to accommodate complex processing equipment, and an adrenal cortex production unit which has been isolated in a small structure with explosion-proof sash to cope with difficult operating conditions, all Upjohn manufacturing activities and storage are now housed on one completely air-conditioned floor in a large building 870 ft wide and 1125 ft long.

CONDITIONED AIR is supplied to all offices, cafeterias, lounges, maintenance departments and shops, as well as production, packaging and warehousing areas at The Upjohn Company's new manufacturing building in Kalamazoo, Mich. The intricate air-conditioning layout designed by The Austin Company actually comprises over 100 individual zone systems, each one supplying air of specified temperature and humidity.

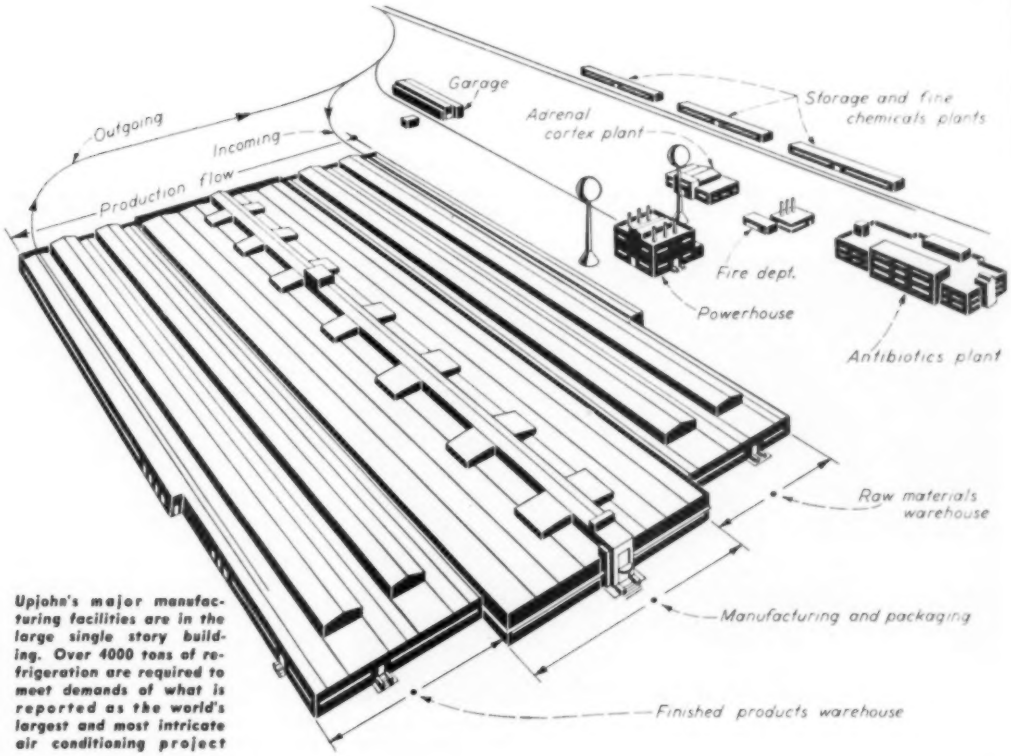
Treated air requirements range from 80 F drybulb and 50 per cent relative humidity—for standard conditions in service areas and plant offices—to 10 per cent relative humidity or less for areas handling hydroscopic materials. Many of the systems have highly complex combinations of equipment in which ultra-violet germicidal lamps, chemical dehumidifiers and electrostatic precipitators are combined with other basic equipment to meet demands

INDUSTRY AND POWER acknowledges with thanks the complete cooperation of The Upjohn Company and The Austin Company in working with editors Wm. J. Hargest, R.A. Moller and A.B. White during the preparation of this article which describes industry's largest air-conditioning project. In particular, we acknowledge assistance of A.A. Hilgart, mechanical engineer of The Upjohn Company, and G.F. Gustafson and A.C. Jutzi, air conditioning engineers in the Chicago district office of The Austin Company.

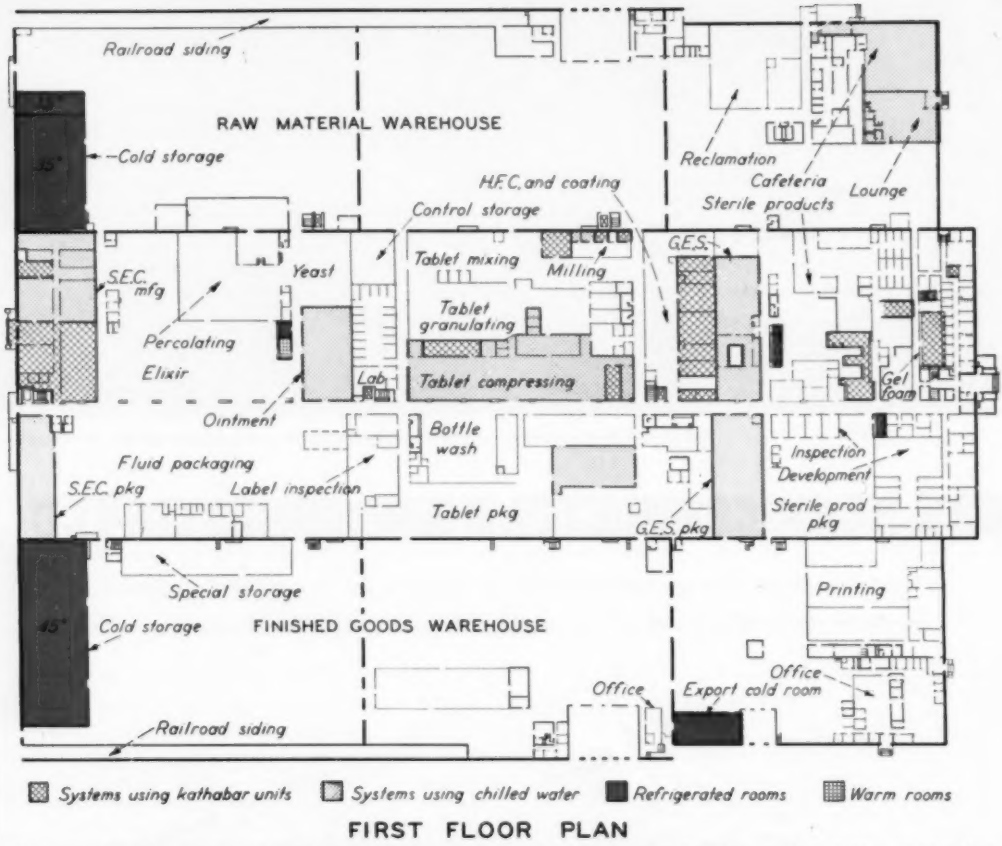
Upjohn and Austin Company engineers collaborated 10 years on design and construction

HAS BEEN COMPLETELY AIR CONDITIONED

Treated air demands range from 80 F drybulb and 50 per cent humidity for offices and service areas to 10 per cent or less humidity for areas handling hydroscopic materials



Upjohn's major manufacturing facilities are in the large single story building. Over 4000 tons of refrigeration are required to meet demands of what is reported as the world's largest and most intricate air conditioning project



FIRST FLOOR PLAN

Many manufacturing areas, and particularly those for sterile production, are served with treated air held to rigid drybulb and humidity specifications. Zone systems for such areas have electrostatic precipitators, dehumidifiers and germicidal lamps

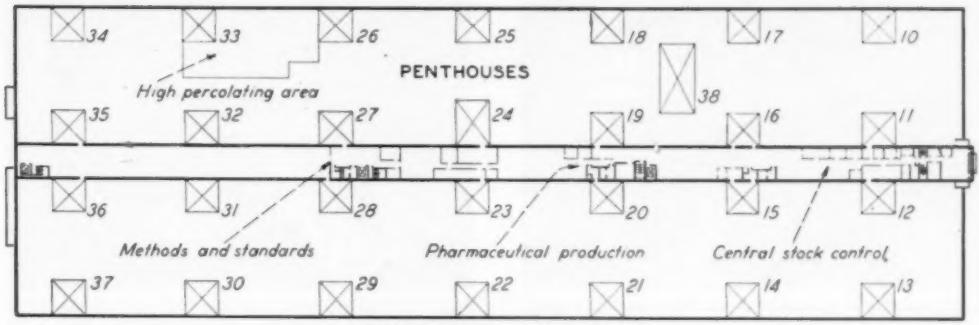
Main cafeteria and lounge have a separate air-conditioning system. Exhaust ducts are located in the dropped section just above the 90 ft serving counter

for absolutely sterile and other favorable manufacturing conditions with a permissible temperature fluctuation of only 2 deg. F.

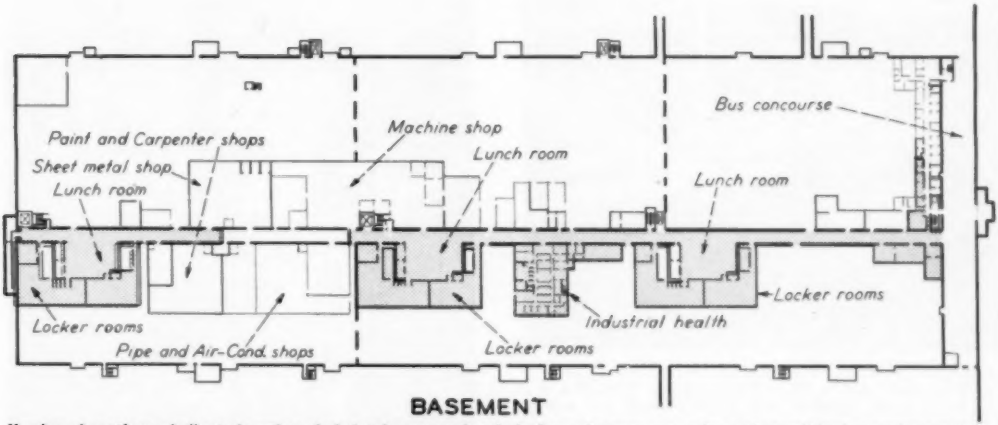
Approximately 100,000 ft of duct work is used to move all the air, which is handled through 2,377 supply and exhaust outlets at the rate of 2,810,000 cfm. Conditioned air is supplied to the plant at the rate of more than 1,220,000 cfm.

Total refrigeration load for the air conditioning systems is 4,000 tons. Of this amount, 1,050 tons is furnished by 40 F water which is chilled to this temperature in surface condensers handling refrigerant from three centrifugal refrigeration compressors. The remainder of the refrigeration load is supplied by 54 F water from deep wells at the factory site.

The plant is laid out as shown on the preceding page. Major manufacturing operations are conducted in a



MEZZANINE FLOOR PLAN



BASEMENT

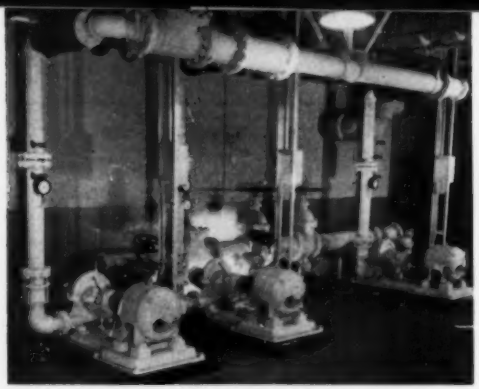
Numbered penthouse indicate location of air intakes on roof and platforms in truss area where air-conditioning equipment is located. Non-colored areas in the drawings are air-conditioned for comfort only, with packaged units being used in basement areas

single one-storey building 870 ft wide and 1125 ft long. It is of "sandwich-like construction, which puts all air-conditioning equipment in the truss area above the finished ceiling and all piping and other service connections in the basement below the main manufacturing floor. As a result, all these services are available instantly for maintenance, repair or change-over operations.

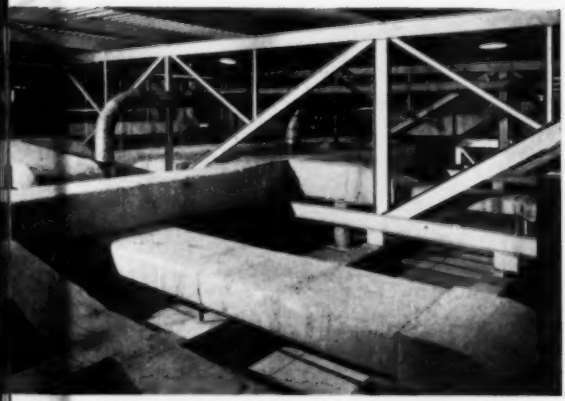
A special integrated patented ceiling lighting system developed by The Austin Company and first applied at the Upjohn plant provides structural support for air-conditioning duct work, air diffusers, sprinkler pipe, acoustic tile and fluorescent-light troffer units. All air conditioning equipment is concentrated in the truss area on reinforced concrete platforms framed directly into standard H-section welded roof trusses. Some 28 of these platforms are above the manufacturing

"Freeze Dry" department is example of process that requires sterile and dry air. System supply ducts incorporate banks of ultra-violet germicidal lamps

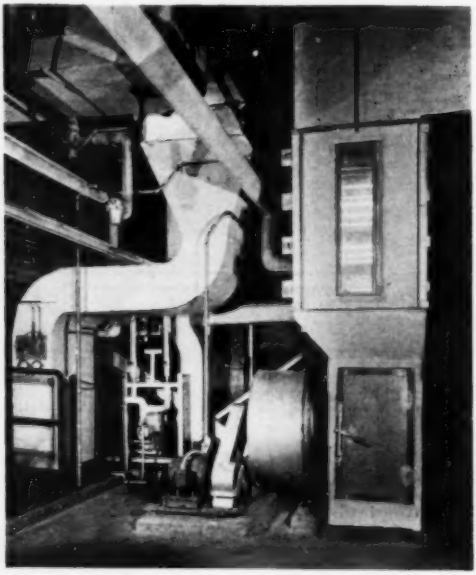
Three centrifugal compressors provide 1000 tons refrigeration for chilled water systems supplying 75 F DB and 40 per cent RH air to the principal manufacturing areas



Banks of high-capacity centrifugal pumps deliver 54 F well water to centrifugal refrigeration compressors as well as to roof sprays and cooling coils in many systems



Fiberglas insulation is applied to more than 100,000 ft of duct work and to fans in truss area. Engineers say it will pay for itself in two years through fuel saving



Plenum chambers in systems supplying air to sterile production areas are equipped with ultra-violet germicidal lamps. Bacteria kill is reported to be 99.9 per cent

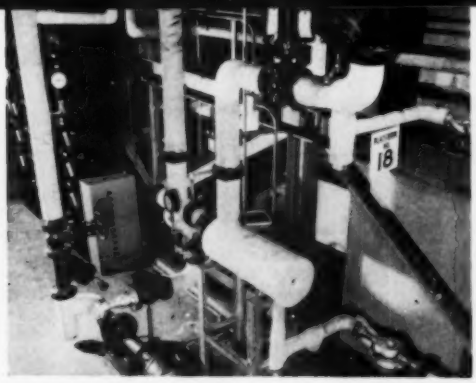
area, while 8 additional platforms hold equipment for controlled air supply to parts of the warehouse where perishable raw materials and finished goods are stored.

Penthouses are located on the roof directly above the platforms. A rectangular air intake with two open sides near the eaves is built on top of each penthouse and runs the full width of the structure. This arrangement has two distinct advantages: (1) fresh air can be drawn in at any damper-controlled point along the entire length of the intake, after which it passes vertically to equipment on the platform below, and (2) high wind velocities have no affect on normal static pressure in intake ducts.

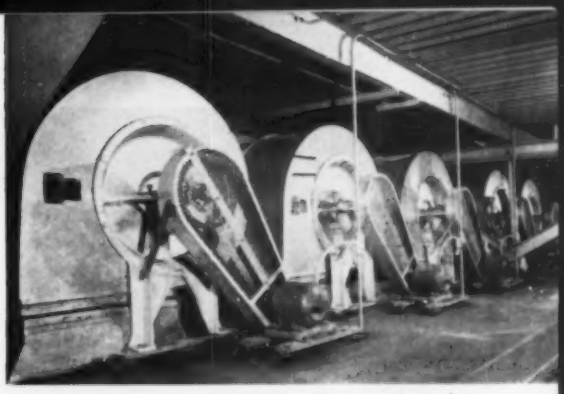
Air for all systems passes through oil bath filters, and then to cooling coils or heating coils as outside air conditions dictate; also, through humidifiers and reheat coils with manual bypass dampers. When outside air temperature drops below 54 F, air entering the systems is preheated with nonfreeze steam coils, using 30 psi steam. After leaving the fan, air passes through ducts to individual zone systems often incorporating electrostatic precipitators, absorption type dehumidifiers and plenum chambers with ultra-violet germicidal lamps, radiation from which reduces microbial contamination to a negligible degree. Diagramatic arrangements of equipment for three typical air conditioning systems are shown in drawings on the following pages.

Comfort Air Supply

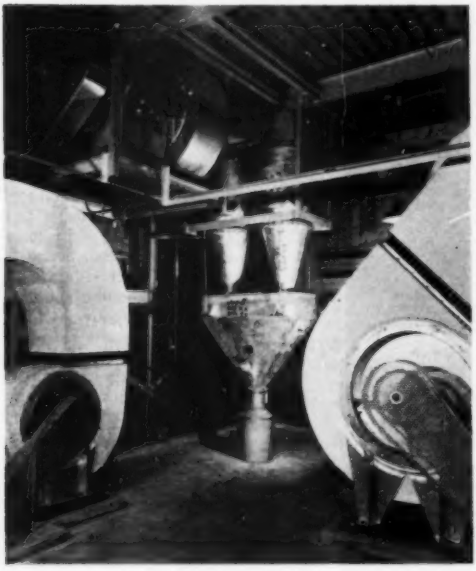
Comfort air conditioning systems utilize well water or chilled water as well as economizer control to maintain a maximum condition of 80 F drybulb and 50 per cent relative humidity. The drybulb temperature of supply air leaving the supply fan is held substantially constant at all times. During cooling periods, heating periods, or intermediate cycles this temperature is maintained between 57 and 59 F. A thermostat located on the outside air intake serves as a change-over unit to place operation of the control system on the summer cycle at an outside air temperature of 54 F and above, and on the winter or economizer cycle for outside air below 54 F.



Air conditioning equipment for each zone is installed on a single platform in truss area. Hot-water converter, pump and controls are seen in this section of platform No. 18



As evidenced by arrangement of these fans supplying air to principal production areas, equipment on platforms in truss space is placed to simplify inspection and maintenance



Two sides of rectangular air intakes on penthouse roofs are open under the eaves for full width of the intakes. High winds do not affect static pressure in intake ducts

Many of the zone treating systems incorporate cyclone dust collectors to clean dust laden air before recirculation in the zone system or before it is exhausted to the atmosphere

During summer operation, flow of cooling water through coils is controlled by a modulating valve in the discharge water line from the cooling coil. The valve is modulated to maintain a fixed air temperature leaving the cooling coil.

During winter operation with outside air temperature below 54 F, a temperature regulator located in the fan discharge modulates a three-way mixing valve located in the return piping from the main hot water heating coil. In turn, the face and by-pass dampers at the steam preheat coil are modulated. Space temperature in each zone of the comfort air conditioned areas is controlled by a zone thermostat reset from the outside air temperature by a compensating thermostat. Each zone thermostat controls the flow of hot water through the zone reheat coil by means of a three-way mixing valve located in the return piping from the reheat coil.

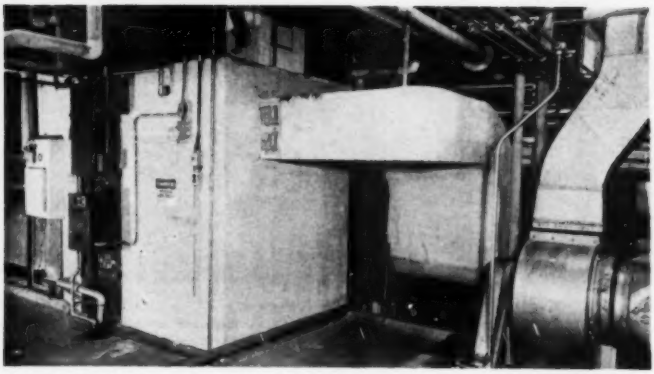
When outside temperature is 95 F, the thermostats maintain zone temperature at 80 F. When outside air temperature is 72 F or below, the thermostats maintain zone temperatures at 72 F. Between these limits, the inside zone temperatures vary in straight-line relationship to outside air temperatures.

Process Air Supply

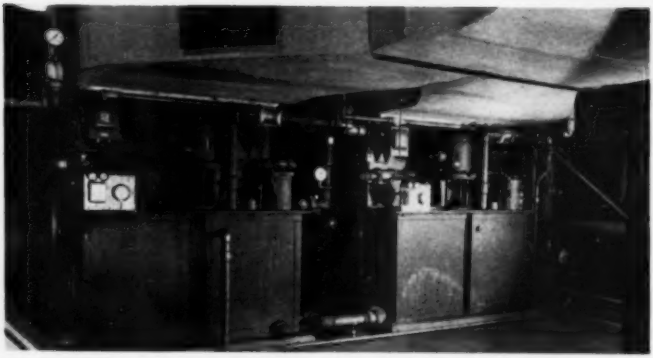
All process air conditioning systems operate on fixed quantities of outside air and return air during normal operation. At periods of plant shutdown and over night, some of these systems can be switched manually to operate on recirculated air only.

Space temperature in each zone is controlled by room thermostats. Each zone thermostat controls the flow of hot water through the zone reheat coil by means of a three-way mixing valve located in the return piping from the reheat coil. These areas are maintained at a fixed drybulb temperature the year round.

In general, humidistats located in the return air ducts maintain specified humidities during the heating cycle by control over a modulating steam valve which admits steam to the humidifying unit. Some systems maintain a fixed relative humidity summer and winter. *(Continued on next page.)*



One of the Electromatic air filters and absorption dehumidifiers (left) which serve special dry process departments are shown on typical platform in trusses



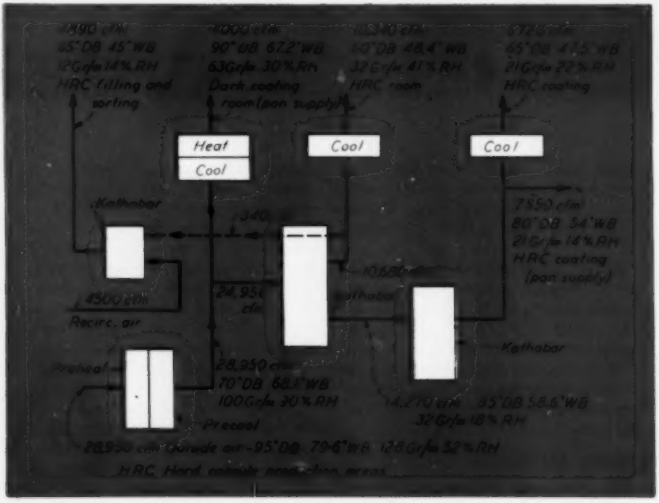
When air with extremely low humidity is required for special dry process departments, the absorption type dehumidifiers are set up for tandem operation

Low Absolute Humidity

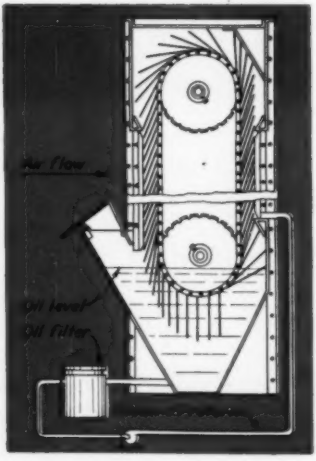
A typical air conditioning system, as shown in one of the accompanying drawings, consists of the necessary preheating and precoiling coils and dehumidification units that are connected in parallel. Design conditions are based on treating 100 per cent 95 DB, 79.6 WB outside air, which contains 128 gr of moisture per lb. This air first passes through a set of coils—one preheats in the winter, the other precools in the summer—so a 70 DB and 100 gr per lb condition is obtained.

Ventilation air is distributed directly to subcooling or reheating stations, as the case may be, while the air for critical humidity areas enters a set of dehumidifying units. This later apparatus consists of Kathabar units combined to form a single duplexing system for parallel operation. The basic dehumidifier reduces the moisture content to 32 gr per lb, while the other units reduce it further to 21 and 12 gr per lb, respectfully.

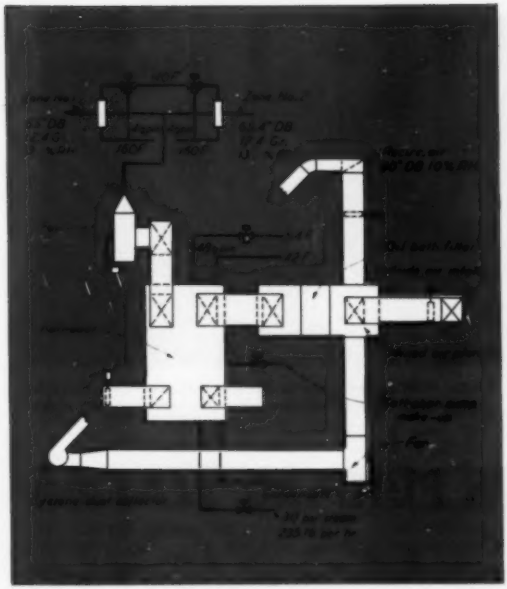
The system handles a total of 28,950 cfm of outdoor air, 24,950 cfm of which enters the basic Kathabar unit where approximately 68 gr of moisture are removed from each pound of air. The chemical reaction—during the process — increases the dry bulb temperature of the air slightly, and for this reason subcooling coils are introduced. These coils remove only sensible heat and reduce the dry bulb to 85 F. As this system handles two arid areas of different relative humidity



Arrangement of dehumidifiers for tandem operation, with portion of air going direct to subcooling or reheat stations for comfort conditioning. Remainder of air is dehumidified and enters dry process zones with RH as low as 14 per cent



Practically all the air conditioning systems have oil-bath filters of this type for initial cleaning of outside air. Use of oil filter automatically removes sludge which is collected in the sump



Typical arrangement of zone systems operating on fixed amount of outside air and chilled water. Both systems use day-night three-way switch for changing from normal operation to shutdown. Thermostats in mixed air plenums stop supply fans when air temperature drops below 36 F. Air conditions in the zones are held constant the year round

two additional Kathabar units are employed.

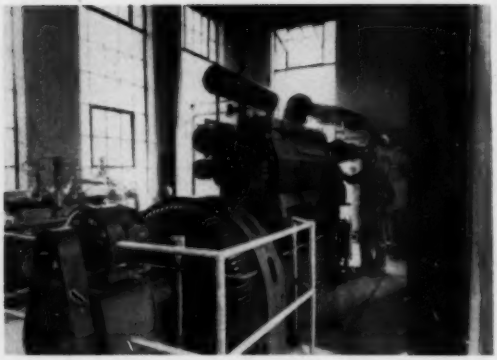
One of the latter handles 14,270 cfm of treated air from the base unit. With the aid of subcooling coils, 6,720 cfm is reduced to 65 DB and only 21 gr per lb. The other unit, feeding 340 cfm of air to a dryer area, holds the same dry bulb but an extremely low absolute humidity of 12 gr per lb.

Kathene is used to absorb moisture from the air in these units, and it is composed largely of lithium chloride. Absorptive powers of the liquid are controlled by solution temperature, so that a definite area humidity level can be maintained. Regeneration is accomplished by merely heating a small part of the solution with low pressure steam to drive off the excess moisture. Hot Kathene flows from the regenerator directly into a sump, where it is cooled and pumped through the flooding nozzles into the air stream. The cycle is completely automatic, and any desired humidity condition can be obtained.

The entire air conditioning system at the Upjohn plant will eventually be automatically operated by time clock controls now being installed. These controls, which will be the subject of a subsequent article, are lined up on panel boards in exact and consistent patterns to guide maintenance men in the servicing of equipment and individual units supplying air to any particular zone in the plant.

LIST OF PRINCIPAL EQUIPMENT IN UPJOHN AIR CONDITIONING SYSTEMS

Air conditioning units	McQuay, Inc.
Bilge pumps	Yeomans Bros. Co.
Centrifugal compressors	Carrier Corp.
Coils, fans and air conditioning units	The Trane Co.
Compression tanks	Bell & Gossett Co.
Condensate pumps	American-Marsh Pumps, Inc.
Controls and recorders	The Foxboro Co.
Dust collectors	American Air Filter Co., Inc.
Dust collectors	Buell Engineering Co., Inc.
Electrostatic and oil bath filters	American Air Filter Co., Inc.
Expansion tanks	Chicago Steel Tank Co.
Fans and air conditioning units	Clarage Fan Co.
Fiberglas insulation	Owens-Corning Fiberglas Corp.
Finned tube radiators	The Vulcan Radiator Co.
Forced hot-water pumps	Allis-Chalmers Mfg. Co.
Gages	Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc.
Gages	James P. Marsh Corp.
Germicidal lamps	General Electric Co.
Germicidal lamps	Westinghouse Electric Corp.
Grilles (air diffusers)	Tuttle & Bailey, Inc.
Heating coils	John J. Nesbitt, Inc.
Heating and cooling coils	The Trane Co.
Heating and cooling coils	Clarage Fan Co.
Hot water converters	American District Steam Co.
Kathabar dehumidifying units	Surface Combustion Corp.
Low-water controller	Mercoid Corp.
Motors for air conditioning	Westinghouse Electric Corp.
Motors for air conditioning	The Louis Allis Co.
No-draft diffusers	W. B. Connor Engineering Corp.
Oil filters	The Hilliard Corp.
Orifices	Republic Flow Meters Co.
Pneumatic controls	Johnson Service Co.
Pressure reducing valves	Bell & Gossett Co.
Pressure reducing valves	Fisher Governor Co.
Propeller fans	Aerovent Fan Co., Inc.
Recirculating pumps	Aurora Pump Co.
Roof spray heads and check valves	A. C. Oughton Co.
Solenoid valves	O. C. Keckley Co.
Space heaters	McQuay, Inc.
Steam humidifiers	Armstrong Machine Works
Steam traps	Illinois Engineering Co.
Surface condensers and turbines	Worthington Pump & Machinery Corp.
Temperature reducing valves	Powers Regulator Co.
Unit heaters	The Trane Co.
Utility fans	American Blower Corp.
Water pumps	Peerless Pump Div., Food Machinery & Chemical Corp.



Supercharged dual-fuel 375 hp diesel drives a 250 kwh generator to supply electrical power for city water pumps

Water from Shawnee Lake flows to the pumping station by gravity and distributed through these motor driven pumps

ECONOMICAL POWER FOR PUMPING STATION

• • • was obtained by the municipality of Shawnee, Okla., when they added a dual-fuel diesel engine generator. Costs dropped from 6.8 mills per kwh to 3.8 even operating at reduced load. When the unit is supplied natural gas, at 88 per cent load, cost is only 2.2 mills

W. B. MORAN, *City Manager*
LESTER BARNGROVER, *Water Supt.*
JAMES B. BENNETT, *City Engineer*

THE SHAWNEE, OKLA., water department has reduced the cost of fuel for generating a kilowatt-hour more than 44 per cent by installing a new dual-fuel diesel engine. At the Shawnee pumping station, about 1 kwh is utilized to pump 1000 gal of water. The new unit, burning natural gas with a small quantity of pilot oil, generates a kwh for an average fuel cost of 3.8 mills. This economy was achieved at an average load factor of only 42 per cent.

This city of 25,000 population provides an abundant water supply and a good, modern handling system, utilizing gravity wherever possible to move the water. A big impounding reservoir, Shawnee Lake, was created in 1935 by the erection of a 50 ft high riprapped earth dam on South Deer Creek. This provided a lake with a surface area of 1320 acres, a drainage area of 26 square miles and and an average depth of 17.2 ft, affording a total capacity of 7.4 billion gal.

Spillway elevation is 1072.5 ft, and the water makes the 5.5 mile trip to town by gravity. It flows first for 29,700 ft through a buried 27 in. concrete main to a valve chamber in an old well field, then another 18,300 ft through parallel lines — an old 18 in. steel and a new 20 in. cast iron main. The mains unite at the pumping station and water flows through a hydraulic gate valve to two settling basins, two sedimentation basins and a clear well that give the plant a storage capacity of 4,500,000 gal. Reservoir plant elevation is 1037.3 ft.

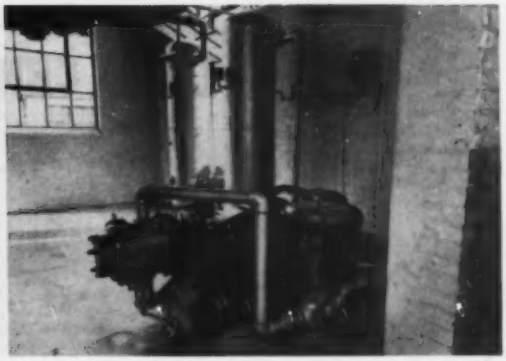
After the clear well, power is required to move the water. Three motor-driven centrifugal pumps do the work: one rated 1350 gpm at a 200 ft head, driven by 100 hp 2300 v motor, one rated 1800 gpm driven by a 125 hp motor, and one rated 2200 gpm driven by a 150 hp motor. For standby service, there is a 2400 gpm pump driven directly by a 200 hp gasoline engine. All the pumps take suction from the clear well through a concrete flume and discharge through gated and checked lines to two 12 in. headers, then through Venturi meters to two 14 in. mains to the city.

Until 1950, power was supplied by a 200 hp diesel capable of running any one of the big pumps. But in recent years, fuel oil has been expensive and the growing city often has required the operation of two pumps. Anticipating these problems the City, in 1946, voted bonds to provide funds for accomplishing certain improvements to the municipal water system including a diesel engine-generator unit.

A four-cycle, supercharged, 375 hp, dual-fuel unit was selected that has six cylinders of 9 in. bore and 11½ in. stroke and developes its rated horsepower at 600 rpm. It drives directly a 250 kw generator with 5 kw V-belted exciter.

Study of operations for the year ending Oct. 31, 1950, shows the effect of the new engine on generating costs. For the five months through March, 1950, the old diesel carried the load. In that period, the pumps handled 225,260,000 gal and 222,200 kwh were produced at an average cost of 6.8 mills per kwh. The new engine went into service in mid-April and for seven months (April through October) the pumps handled 391,093,000 gal. Kilowatt-hour production for the period was 396,400 with the new engine contributing 341,600 kwh. Based on plant records for this seven-month period, the engine produced a kwh at 3.8 mills. This saving of 3 mills per kwh is by no means a measure of the economy potential, for greater efficiency is obtainable.

Lube oil from the diesel sump passes through this fuller's earth filter, is cleaned and returned to the lube system



Natural gas pump increases supply from 3 to 25 psi. Fuel enters the engine at 13 psi through a reduction station

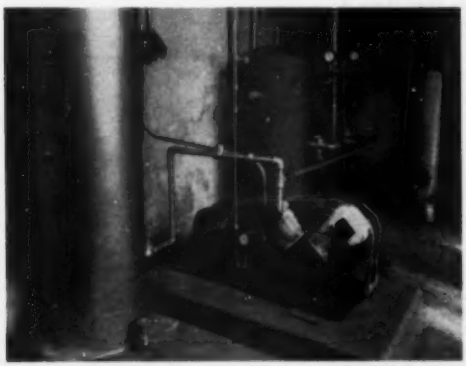
On April 10, 1951 the city ran a five-hour test with two big pumps providing an 88 per cent load. For two hours, the engine ran as a full diesel and generated 438 kwh on 238 lb of fuel oil, an average of 0.544 lb per kwh. The unit was then switched to dual-fuel operation and ran for three hours, producing 646 kwh while consuming 4.2 gal of pilot oil and 5960 cu ft of natural gas. This is an average of 9.22 cu ft of gas and 0.0065 gal of oil per kwh. At the average prices paid by the city, this represents a fuel cost of 2.2 mills per kwh.

Gas reaches the plant at a pressure of 3 psi and must be boosted to 13 psi before entering the engine gas header. To accomplish this, the gas is compressed to 25 psi by a motor-driven compressor and then put through a regulator tank, which is kept at 13 psi. This provides a dependable constant pressure. The fuel oil for the plant is stored in a 130,000 gal concrete tank formerly used as a clear well. An automatic, float-controlled motor-driven pump transfers fuel from storage to a 300 gal elevated day tank from which it flows by gravity through individual filters and meters to the two engines. The dual-fuel unit switches instantly to oil if gas pressure fails and shuts down automatically if pilot oil pressure fails.

Cooling water is circulated through the engine jackets and a heat exchanger by a motor-driven centrifugal pump. A thermostatically controlled valve by-passes some jacket water around the exchanger to keep temperature at the desired level. Raw water flows by gravity from the filter wash water tower through the exchanger into the settling basin.

Lube oil temperature also is kept at the desired level by a thermostatic valve, which bypasses oil around the oil cooler. The lube oil is cleaned continuously in a fuller's earth filter. Oil is drawn from the sump by a motor-driven pump, put through the filter and returned to the sump. Intake air is drawn through an oil-bath filter outside the plant and is supplied to the cylinders under pressure by the exhaust-driven turbocharger. The exhaust gases vent through a snubber.

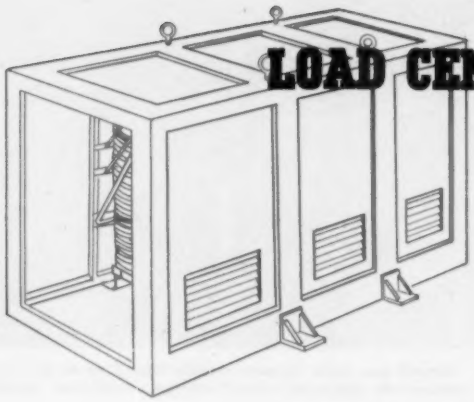
Conveniently mounted on the engine is a compact gage and alarm panel, which tells the operator the inlet and outlet temperatures of lube oil and jacket water, lube oil pressure before and after the strainer, fuel oil pressure before and after the filter, jacket water pressure at the engine and starting air pressure. An alarm sounds if gas pressure, water temperature or pressure, or lube temperature or pressure should go outside prescribed limits. Also on the gage panel is a multi-point exhaust pyrometer.



The new diesel unit is started on air supplied from this compressor. Air is stored in two constant pressure tanks

PRINCIPAL EQUIPMENT AT SHAWNEE PUMPING STATION

Diesel engine	Nordberg Mfg. Co.
Generator	Electric Machinery Mfg. Co.
Turbocharger	Elliott Co.
Governor	Woodward Governor Co.
Fuel transfer pump	Worthington Pump & Machinery Corp.
Fuel filters	Wm. W. Nugent & Co., Inc.
Fuel meters	Buffalo Meter Co.
Gas compressor	Ingersoll-Rand Co.
Heat exchanger	Ross Heater & Mfg. Co., Inc.
Jacket water pump	Allis-Chalmers Mfg. Co.
Lube oil purifier	The Hilliard Corp.
Lube oil filters	Wm. W. Nugent & Co., Inc.
Lube oil cooler	Ross Heater & Mfg. Co., Inc.
Air filter	American Air Filter Co., Inc.
Exhaust silencer	Burgess-Manning Co.
Alarms	Viking Instruments, Inc.
Gages	U. S. Gauge Co.
Pyrometer	Illinois Testing Laboratories, Inc.
Air compressor	Worthington Pump & Machinery Corp.



LOAD CENTER COMING? INSTALL IT RIGHT

Final part of this article summarizes the best methods for installation and assembly of various types of equipment so that designed-in features will be preserved for a long and efficient life

GEORGE WOOD, Substation Section; Allis-Chalmers Manufacturing Company

METHODS and precautions for unloading, moving and storing substation equipment were treated in the first part of the article which appeared in the May, '51 issue. Here are procedures for the actual installation.

Most difficult part of the substation to handle or align should be positioned first so that work involved in later moving or adjusting can be kept to a minimum. The transformer is usually the heaviest and hardest part to handle, although there are exceptions, as where switchgear with risers must be connected to existing bus duct. Also, with double ended substations, the switchgear is usually positioned first and space limitations may affect choice.

Switchgear Positioning

Transformers need only be placed on a perfectly level surface, since their weight prevents them from moving once they are located. The surface should be smooth and dry, with good drainage and strength to bear weight.

Indoor, high-voltage, metal-clad switchgear is usually designed for fastening to a channel iron grouted or set in the concrete foundation pad. The gear has a metal floor which rests directly on the channel-iron base to which the switchgear may be secured by either bolting or welding. Fig. 1 shows a typical floor plan.

Channel iron sills are furnished by the purchaser and set in the concrete foundation or floor at the time of pouring, and in accordance with the manufacturer's drawings. It is essential that foundation provisions follow the manufacturer's directions.

Outdoor high voltage, metal-clad switchgear for connection to the primary side of a load-center transformer is generally equipped with a steel I-beam or channel-iron sill, approximately 6 in. high, to be bolted to the concrete foundation. Typical securing members are shown in Fig. 2. The outdoor, low-voltage, metal-enclosed type for connection to the secondary side is usually similarly secured.

Low-voltage, metal-enclosed switch-

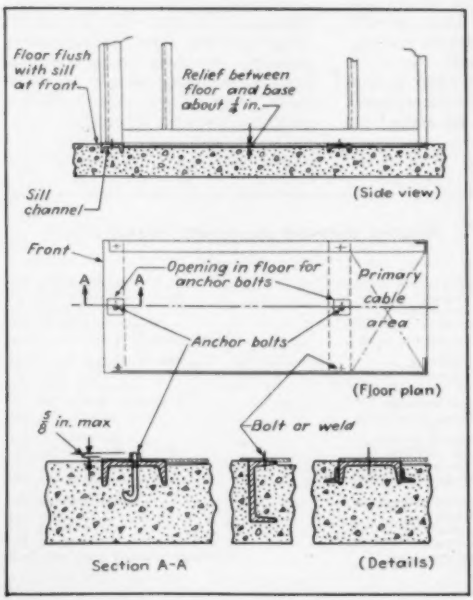


Fig. 1—Left. Most indoor high-voltage switchgear fastens to channel iron that is grouted into the concrete foundation by the purchaser. Floor is flush at front but relief in area between channel irons insures that there is no interference with floor of switchgear unit. Grouting, fastening details are in drawing at right

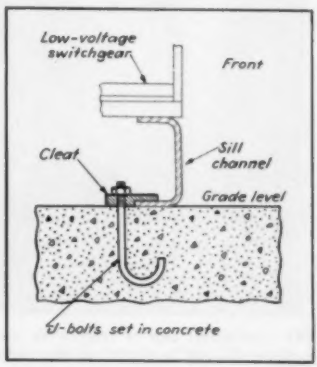


Fig. 2—Right. For outdoor high-voltage switchgear and other types provided with sill channels, this method of fastening in position is commonly recommended

gear, designed as a part of the load center unit substation, is made with or without channel sills depending upon the manufacturer. Units *without* channel sills may be secured by the same means described for the high-voltage, metal-clad switchgear. Designs *with* channel sills are usually secured to the foundation by means of anchor bolts and cleats, Fig. 2.

A suggested procedure for positioning both high and low voltage, indoor and outdoor switchgear follows:

1. Examine the drawings for the proper sequence of switchgear groups in relation to the transformer. This is important where a number of switchgear compartments appear similar but are not exactly identical as to breaker size, trip coil rating, meter and relay components or other variables.

2. If J-bolts are used for securing gear to the floor, they must be protected before moving the switchgear into position. With a washer below, run on the nut until hand tight.

3. Place a row of timbers or rails on the outside and parallel with the rows of J-bolts, Fig. 3.

4. Place pipes or rollers over the rows of timbers or rails.

5. Bring the first group of gear—which fits directly to the transformer—up to the foundation and place on the rollers, lifting by one of the two means described in the preceding installment.

6. Roll the unit towards the transformer until approximately in the final position. Refer to substation elevation drawing furnished by manufacturer for detailed information.

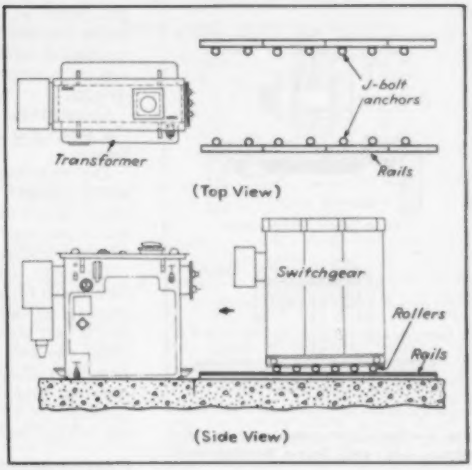
7. Lift the group to remove the rollers and rails. Carefully lower it to the foundation, as close as possible into the final location (sills between the two rows of J-bolts or immediately over the grouted channel irons.)

8. Position the other switchgear groups.

9. Using crowbars, and overhead lifts if available, align transformer and switchgear groups and fasten as prescribed by the manufacturer.

Fig. 3—After transformer is positioned, switchgear units can be rolled into place without the aid of overhead lifts by use of rails high enough to clear and protect J-bolts set in concrete floor as shown

When unit is close to final position, it is lowered and aligned with crowbars or other aids available. Raise and lower units with precautions described in first installment of article



Connections

In most cases, connections between transformer and switchgear buses are made with flexible copper connectors supplied by the manufacturer. *Be certain* connections are tight since joint conductivity depends as much on pressure of contact as on the area. When bolting buses together, apply force to the nut and bolt without straining the buses or their support. Replace and *discard* stripped bolts and nuts.

Bus connections between transformer and switchgear differ slightly from those between two groups of switchgear. Switchgear buses may be joined with serrated or wavy splice plates, Fig. 4, or with plain splice plates and bolts equipped with spring washers for proper contact and allowance for bus expansion and contraction. Where spring washers are used, the bolts should compress the spring washers 40 per cent of their total possible deflection.

Outdoor Units

Liquid-filled outdoor transformers and low voltage switchgear are generally throat connected, although details vary somewhat with the size, basic design and type of construction. A common connection is the drop-collar arrangement, Fig. 5, used to eliminate gaskets and to provide flexibility in positioning the substation components. otherwise, a plain transformer throat to switchgear throat connection is usual.

Outdoor dry-type transformers and switchgear are connected in the same manner as two groups of switchgear. A general procedure is:

1. Position transformer and switchgear groups in order called for by the general arrangement and floor plan.

2. Fasten groups together. In most cases bolts will be used for this purpose.

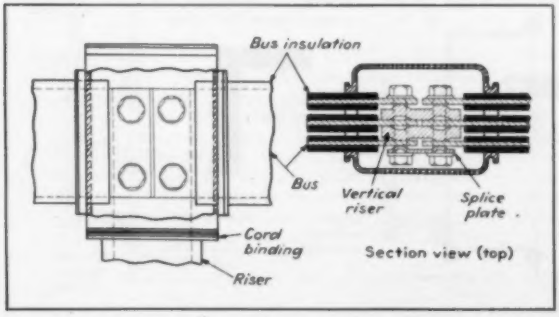


Fig. 4—Typical, insulated switchgear bus connection with one type of pressure plate. Plastic cover-box also shown

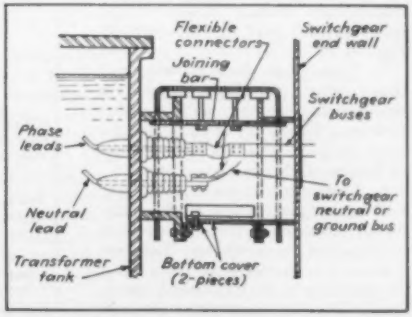


Fig. 5—Outdoor liquid-filled transformers and low-voltage switchgear often use drop-collar connection at the throat

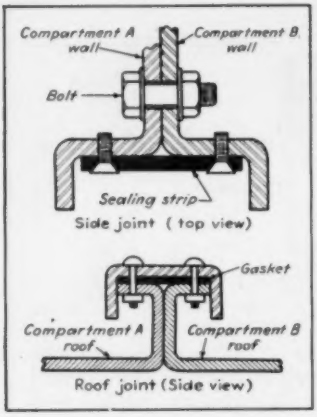


Fig. 6—These seals often used on sides, above, and roofs, below, between units

3. Attach vertical sealing strips over junctions between groups, Fig. 6.

4. Position gaskets and formed metal troughs over junction ridges on roof of equipment, Fig. 6.

5. Align substation components.

6. Secure sill channel to anchor bolt or sill channel iron set in the concrete foundation.

7. Complete bus connections between transformer and switchgear and/or between adjacent shipping groups of gear in accordance with preceding directions. Note that all high voltage bus connections are to be insulated (a review of instructions for high voltage bus joints is contained in the appendix.)

8. Complete all secondary control wiring connections (if any) between adjacent units according to wiring diagrams using the 600 v insulated wire supplied. Refer to master wiring diagram supplied with the job drawings for directions.

Indoor Units

Liquid-filled, indoor load-center transformers connect to low-voltage, metal-enclosed gear by two methods, Fig. 7:

1. Transformer throat to switchgear throat, where the throat flanges are simply bolted together with a gasket between. Electrical connections are made by means of access plates on top or bottom of the switchgear throat.

2. Transformer throat to switchgear wall connection consists of the transformer throat which covers an opening in the side of the switchgear. The joint is secured mechanically by bolts along the periphery of the transformer throat flange. Electrical connections are made by removing the bolted sheet steel rear cover plates. In most cases, the switchgear buses will terminate in flexible copper connectors which permit slight mechanical variations as well as expansion and contraction due to temperature changes.

Connections to high-voltage, metal-clad switchgear are by means of similar throats.

Dry-type load-center transformers, where possible, also should be positioned before the switchgear is placed and in the same manner as liquid-immersed transformers.

Generally, the case of a dry-type transformer has no end plates, since the primary termination (terminal box, switch, or high-voltage switchgear) closes one end and the low voltage switchgear closes the other. All primary bus joints must be insulated as provided for by the manufacturer; all low voltage buses and joints are bare.

Final Inspection

After the substation is located at the final site, properly positioned, aligned, fastened to the foundation and connected (but not energized), the equipment should be thoroughly inspected for possible damage incurred enroute.

Remove any remaining packing, bracing, shipping channels, sills, bars, rods, spikes or blocks used to protect the equipment during shipment. Carefully check meters and instruments and inspect all relays for damage. Test doors and hinged panels for free operation. Look for misalignment, dents and bumps which might indicate possible internal damage. Check for tank leaks, broken instruments, guages, dials or indicators on liquid-filled transformers. Look for mechanical damage to insulated current carrying parts of dry-type transformers where case, core and coils are shipped in separate containers.

For extra protection, some parts of load-center unit substations may be crated and shipped separately from transformer and switchgear proper. Such items usually include circuit breaker elements, drawout potential and control-power transformers on their drawout carriages, and primary fuses. These should be carefully uncrated, inspected and inserted into their proper place after the final detailed inspection of the unit.

The foregoing instructions should enable you to properly receive, unload, store if necessary, position and assemble a load-center unit substation. They do not, of course, cover every possible situation which may arise, but serve merely as a general guide and recommendation. The factory representative should be consulted in the event any conflicting directions are received.

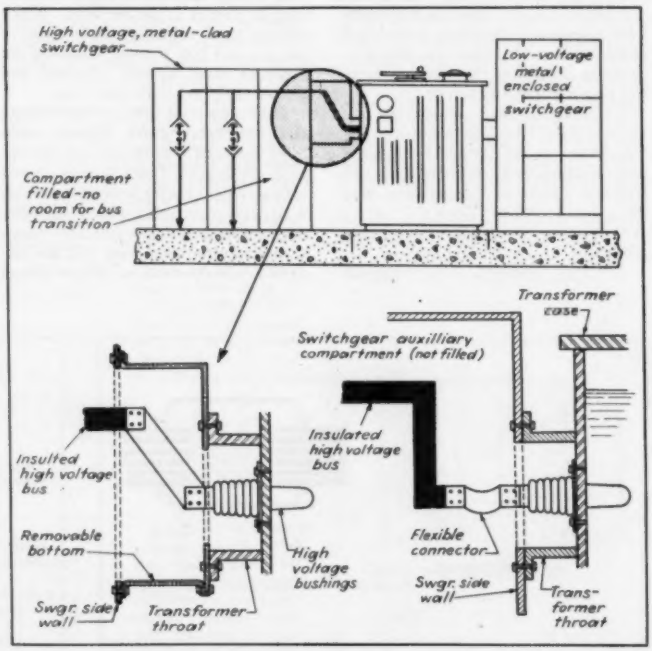


Fig. 7—Arrangement in auxiliary compartment may require switchgear throat, lower right. Transition room in compartment, right, allows closer positioning

APPENDIX

Taped No-Corona Joints: Materials normally supplied for each bus joint to be made are given in the table. Joints between shipping groups of high voltage metal-clad switchgear and between transformer and switchgear bus should be insulated at the substation site, after installing and before final inspection and testing, in the following manner:

1. Check each bus joint to see that it is properly made and that all bolts are tight. Note that where spring washers are used, the bolts should be drawn up to compress the washer 40 per cent of its total possible deflection, or between 3/64 in. min. and 1/16 in. max. All other bolts should be tight.
2. Wrap each joint with the no-corona copper mesh tape. Use enough to form a regular surface (not necessarily straight) over bolt heads, nuts, sharp corners and edges. The purpose of the copper mesh is to avoid sharp points or edges with their corona-producing potential gradients.
3. Wrap each bus joint with three layers of black empire cloth sheet. Use strips wide enough to overlap adjoining layers approximately 1½in. Stagger ends so that they do not fall on one part of the bus.
4. Tie empire cloth firmly with bias-cut yellow empire cloth tape; .01 in. thick by .75 in. wide is recommended and supplied by most manufacturers.
5. Repeat steps 3 and 4 twice for 2400-7500 v equipment, three times for 15,000 v equipment.
6. Tape the entire joint with one layer of 0.005 x 1.00 in. cotton staybinder.
7. Paint joint with air drying varnish supplied by manufacturer.
8. Let varnish dry approximately three hours before energizing the bus.

MATERIALS SUPPLIED FOR NO-CORONA JOINTS AT VARIOUS VOLTAGES

	7500 v or less	7501 to 15,000 v
Empire Cloth (0.10 x 12.0 in.)	3 ft	7 ft
Yellow bias tape (0.10 x 0.75 in.)	10 ft	10 ft
Cotton staybinder	18 ft	18 ft
No-corona copper mesh tape	2 ft	2 ft
Air-dry varnish	1/6 pint	1/6 pint

Compound Filled, Molded-Cover Joints are made as follows:

1. Remove all molded plastic bus joint boxes from the buses.
2. Clean all silvered bus contacts with carbon tetrachloride or other grease solvent. *Do not clean silvered joints with sand paper.*
3. Assemble bus joints with splice plates furnished by manufacturer. Tighten up the bolts enough to compress spring washers approximately 40 per cent. If corrugated splice plates are used, draw up the bus bolts as tight as possible.
4. Place molded plastic covers around joints, Fig. 4.
5. Add filler pieces to bottom to prevent leakage of compound while pouring.
6. If sealing compound is provided, apply to joints in moulded covers to help make box free of leaks.
7. Securly bind box in position with cord supplied.
8. Paint cord with air drying varnish supplied by manufacturer.
9. Heat joint compound to approximately 190 C. Avoid overheating, since dielectric strength may be seriously affected, but melt compound sufficiently to pour freely.
10. Slowly and intermittently pour the molten compound into box, allowing an interval of cooling to prevent formation of gas or air pockets. Final pouring should be made only after the previously poured compound has cooled somewhat, and should fill box level with the top.

Key Type Interlocks: Manually operated, key type interlocks are used to insure a predetermined sequence of operation. Two of the most common uses for key interlocks are on magnetizing-break primary switches to prevent operation under load, and on bus tie breakers to prevent closing when one or more source is connected to the bus. They are also used for many other purposes. When supplied, interlocks will be covered in the manufacturers specifications for each specific job application.

Each interlock is shipped with a key inserted so that each mechanism involved in the interlock scheme can be tested independently. *Unless the extra keys are removed,* the entire interlock system is defeated and is of no protection whatever.

It is recommended that immediately after erection of a unit substation, the interlock system, if present, should be checked for sequence of operation and extra keys removed. Do not energize the unit until the interlock system is checked and put into operation and do not permit access to spare keys except through proper channels.

The Cover Illustration—Low Cost Horsepower for Gas Transmission

● Shown on this month's cover is El Paso Natural Gas Company's Keystone Main Line Compressor Station near Kermit, Texas, which has ten Cooper-Bessemer Type GMW V-angle gas engine compressor units producing a total of 15,000 hp. Eight units have a suction pressure of 490 to 530 psi and a discharge pressure of 830 psi for transmission on the main line. The other two units add gas from field gathering stations at a suction pressure of 40 to 50 psi, compressing it in two stages to discharge into the other higher pressure units.

The company's main pipe line extends from the Permian Basin in southeastern New Mexico and Western Texas to California.

The Cooper-Bessemer Corporation, long associated with the nation's power needs, started in 1833 producing simple foundry blowing machines. It is now making the most advanced diesel and gas engines, compressors and allied equipment. Units shown were recently developed to meet the demand for lower cost installed horsepower in gas transmission, pressure maintenance and recycling service. They are two cycle gas engines, built in six, eight and ten cylinder sizes, developing up to 3000 hp.

COSTLY BUT .

HERBERT CHASE, Consultant

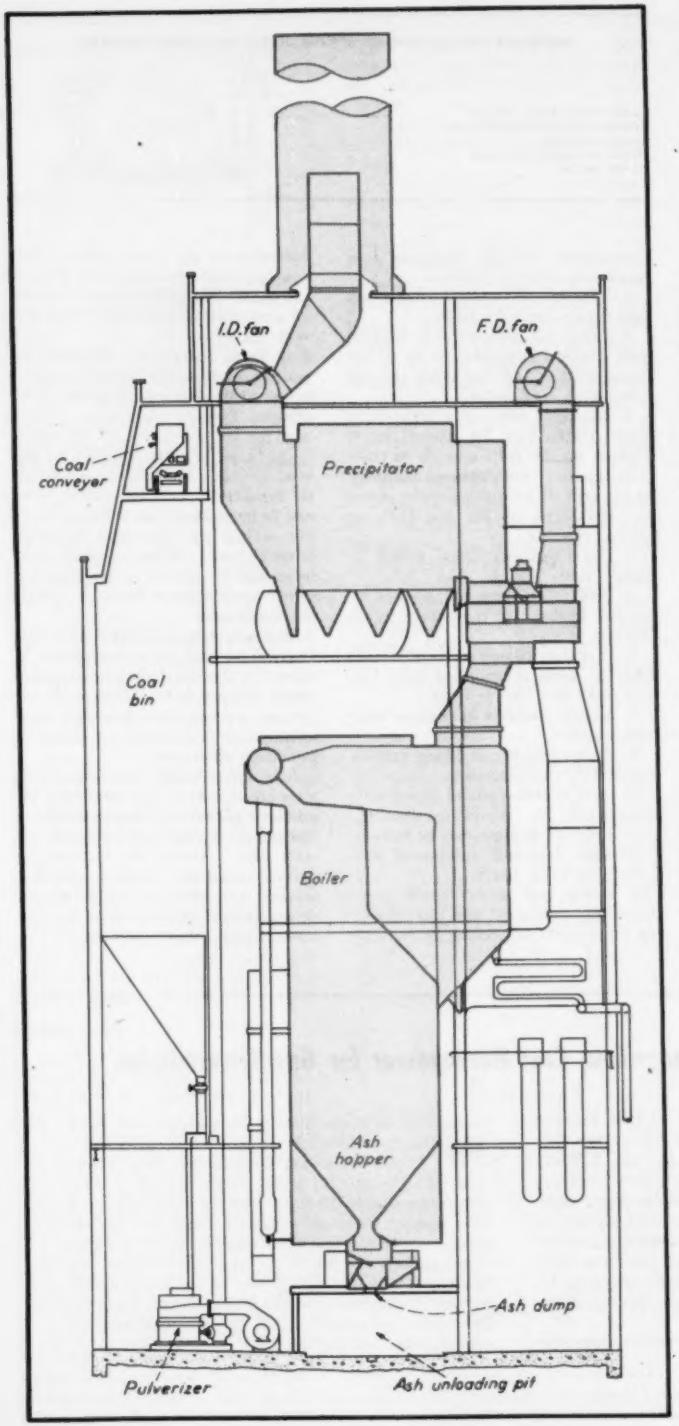
DURING the 15 year period ending 1953, Consolidated Edison Co. of New York, Inc., which supplies the city with power and light and through subsidiaries gas and heat, will have spent some $21,000,000 on its smoke abatement program alone. All of the company's generating stations and some other plants are included in the program and are now well equipped to minimize the solid matter from gases leaving stacks, although the program is by no means complete.

Both modernizing of old equipment and installation of new for increasing capacity are proceeding and are expected to continue, perhaps indefinitely. Wherever smoke is an actual or potential problem, efforts to minimize and abate the nuisance are in constant effect.

Although the bulk of expenditures for smoke abatement has been on equipment designed specifically to remove fly ash and soot from gases entering stacks, there is a specific and well coordinated program for operating equipment in such a way that a minimum of smoke is produced in boilers. Every generating plant has its crew trained to hold optimum combustion conditions and to correct the causes of smoke as quickly as conditions permit.

Complexity

Problems encountered in smoke abatement are highly complex. They are augmented by the fact that fuel varies more or less in quality. Further, several stations burn both oil and coal. Still another will burn oil, coal and gas, using the latter when it is available during the warm months. Stacks are watched not only by operators at the generating stations, but also by an observer at the company's main office. He can see all stacks of four major plants, and he informs station operators when smoke occurs.



Flue gases pass through an electrostatic filter. Solid particles are discharged to the main ash pit which is equipped for dustless ash removal

. . .SMOKE ABATEMENT REALLY PAYS OFF

Consolidated Edison Co. of New York Inc., has spent over $21,000,000 to hold smoke to the minimum. Most systems incorporate electrostatic precipitators in combination with cloth bag or cyclone collectors. A television camera is used to detect smoke

At most stations, however, two or more boilers feed flue gases into a single stack. When smoke is produced it is not always easy to determine the boiler or boilers that are at fault and, even when this is known, to find the cause and correct it quickly. The problem is aggravated by the fact that loads have constantly increased and stations must operate most of the time at or near capacity to meet demands.

Trained Operators

At all plants, however, operators are well trained and can call at any time on one or more engineers for aid in correcting combustion or other faults whose cause may not be immediately apparent.

Besides the common means of observation, some use has been made of electric eye equipment at boiler breechings to detect changes in gas color. Such equipment has decided limitations but one of the newer forms, sensitive to infra red light, is thought to hold promise. In somewhat the same category is the use of CO_2 indicators and paramagnetic indicators for oxygen content. These have been given trials that are being continued especially as a check on combustion efficiency. But the difficulty of obtaining representative readings are recognized, inasmuch as single readings at specific points may either be helpful or misleading because of possible stratification.

Problems in such respects are more complex when fuels are changed, as the optimum fuel-air ratio changes with the fuel. Clogged oil burners and a host of other variables that may occur in operation have to be given attention; therefore, judgment needs to be used in applying the remedy.

One of the latest means for checking on smoke issuing from the stack is a television camera, which has been installed on the roof of a nearby building and focused on Waterside station. The camera is connected by coaxial cable to a viewing screen at the operator's control panel in the Waterside station. With this arrangement smoke can be seen when it issues from the stacks. Lighting the background affect the clarity of the image, but some favorable results have been reported. (INDUSTRY & POWER, December, 1950, page 78.)

Solids in flue gases leaving boilers consist mostly of fly ash when coal is being fired. For removal of this fly ash, as well as some other solids, dependence has been for many years and still is largely on electrostatic precipitators. These units, charged by d-c high voltage, may be supplemented on future installations by multiple cyclones or equivalent equipment especially for removal of most of the coarser particles by inertia where a change in direction occurs. In reality some 80 per cent or more of the total investment in smoke abatement is in electrostatic and mechanical devices.

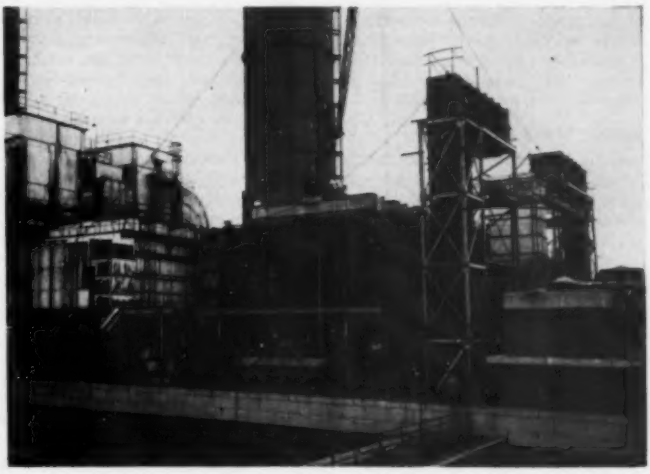
For many years, precipitators were subject to the disadvantage of emitting puffs of smoke when the plates were struck to jar loose deposits collected thereon. This fault is largely if not completely overcome in late installations by providing for continuous rapping of individual plates or by dampering each passage of the precipitators while being rapped. When dampering, the passages are cleaned in set sequence and all save the one being cleaned remain open so that draft remains substantially unchanged.

One of the latest precipitators is currently being installed at the Hudson Avenue station to serve a boiler having a capacity of 1,370,000 lb of steam per hour. The precipitator measures 90 ft wide, 45 ft long and 15 ft high and is located at ground level.

There are five channels with individual draft control, each containing two sets of rectangular ground plates and one set of V-shaped plates. Only the edges at the outside of the V are swept by gas at maximum velocity. Total gas flow through the precipitator is 608,000 cfm at 270 F.

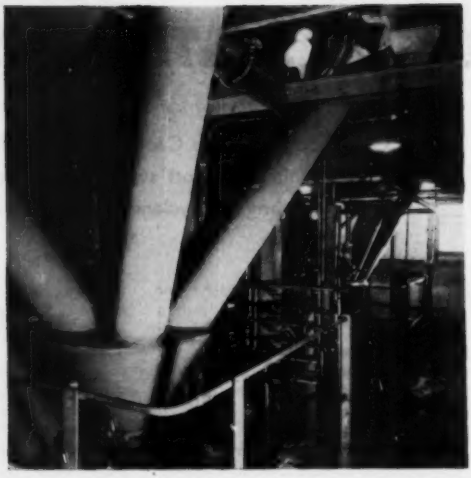
Flue Gas Passage

Preceding entry into the precipitator, the flue gas passes through a multiple cyclone that has 10,212 individual passages. This unit is de-



Electrostatic filter at the East River station can handle 608,000 cfm of 270 F flue gas. This unit is operated at approximately 90 per cent efficiency

Cloth bag type filter system installed at the East River station traps coal dust entrained in pulverizer mill vents



Activator units shake cloth bag filters periodically and collected pulverized coal is returned to the mill supply

signed to remove most of the coarser fly ash, leaving the finer particles for removal in the more efficient precipitator unit.

Smoke abatement, as it affects communities surrounding a power plant, is not entirely a matter of removing solid particles. It is highly desirable to dissipate the gasses issuing from stacks over a large area. When this can be done, any solids remaining and the gases, if and when they come to earth, are so widely dispersed as to cause no serious troubles.

High stacks are generally recognized as the best and probably the most economical means of gaining wide dispersion. But there are locations, especially near airports (as in the case of the proposed Astoria Consolidated Edison station), where stack height is limited by aeronautic or local regulations. Then other means must be taken to effect proper dispersion.

Smoke Stack Research

Partly for this reason, Consolidated Edison has instituted a research program, a part of which involves wind tunnel tests, to learn what can be done to increase dispersion where relatively low stacks must be used. It is still too early for general conclusions to be drawn, but research already conducted elsewhere has shown higher stack velocity exit has the effect of increased stack height.

Greater volume can increase the velocity of gases, of course, but there are economic limits in respect to the power and to the investment in equipment that are expedient for such purposes. Demonstration has shown, especially in some Chicago stations where relatively low stacks are essential, increased exit velocity can be attained more economically by contracting the stack into a nozzle of proper size at the top. This expedient may be adopted in the new stack to be erected at the Astoria station but details of stack design have not yet been determined.

Air Disturbances

Other factors, such as the effect of adjacent buildings, including the power plant housing, are being studied, as eddies are known to be created that have adverse effects upon the gas plume leaving the stack. Actually, the problems involved are highly complex and the best engineering solution apparently must await the results of numerous tests and, presumably, the formulation of a theory yet to be evolved, to govern a rational design.

Although smoke abatement involves the near elimination of dust issuing from stacks, dust from other sources may be serious and require substantial investments for its control or elimination. This proved to be true at the East River and Kips stations where there are installations for grinding coal and storing it prior to feeding it to boilers. After these installations were made, it was found that losses in dust created local problems.

The remedy was to install bag type systems (at a cost of about $1,000,000 at East River) in which the air containing the dust is drawn off and exhausted through bags in which the dust is collected. This dust is subsequently fed to furnaces and has reduced the net coal loss to less than 0.03 per cent besides practically eliminating the dust nuisance in and adjacent to the coal grinding buildings. In later installations, grinding mills are placed adjacent to boilers and coal is ground as needed, no storage in pulverized form being required, so that the dust from pulverizing is not a significant factor.

Details of ash handling need not be given here but it may be said that they include means for keeping dust from becoming a local nuisance. At Waterside station, for example, there are two complete sets of ash handling equipment that include bag filters, the ashes being deposited in ash silos on the docks. Dust collected by precipitators and elsewhere is conveyed pneumatically into silos. The ash is mixed with sufficient water to coagulate the dust before being loaded on trucks or barges for transportation.

Problem Never Ending

Although the foregoing is only an outline and includes chiefly highspots in the smoke and dust abatement program of the company, it is evident that the problems involved are being given the attention desired. A large and increasing investment in smoke and dust abatement has been and is being made. As new generating capacity is added, it includes the latest and most effective means for smoke and dust control and operation is constantly being watched and improved to minimize smoke production.

CENTRIFUGAL PUMPS . . . . . CASING DETAILS AND CONSTRUCTION

IGOR J. KARASSIK and ROY CARTER,
Application Engineers,
Worthington Pump & Machinery Corporation

Analysis of the component parts* which, after assembly, combine to make a centrifugal pump. The authors show the relationship the parts bear toward one another in producing a pump designed to fit the job

ESSENTIAL structural parts of any centrifugal pump are the rotating element, comprised basically of a shaft and impeller and the stationary element made up of casing, stuffing boxes and bearings. All other parts are refinements of construction, which supplement the functions of these essential elements.

Besides the purpose of containing the liquid being pumped, the function of the pump casing is to reduce the velocity of the liquid discharged from the impeller and thus transform kinetic energy into pressure energy. Centrifugal-pump casings can be classified into two basic groups with respect to the type of energy conversion:

(a) Volute type
(b) Diffuser or turbine type

The volute-casing pump, Fig. 1, obtains its name from the spiral-shaped casing surrounding the impeller, which collects the liquid discharged by the impeller, and converts velocity energy into potential energy. The volute of a centrifugal pump increases in area from the initial point until it encompasses the full 360 deg. around the impeller and then flares out to the final discharge opening. The wall dividing the initial section and the discharge-nozzle portion of the casing is called the tongue of the volute or the "cut-water."

The turbine pump is so named because its concentric casing with diffusion vanes resembles conventional water-turbine casing construction. The diffusion vanes and the concentric casing fulfill the same function as the volute casing in energy conversion.

In certain applications such as propeller pumps where axial flow impellers are used, it is not practical to use a volute casing, and the impeller is enclosed in a casing formed as a pipe. Generally diffusion vanes are used following the impeller proper, but in certain extremely low-head units, these vanes may be omitted.

A diffuser-type centrifugal pump is illustrated in Fig. 2. The development of the diffuser produced an appreci-

* This article will be included in a book on centrifugal pumps now being prepared by the authors; hence all rights to republication are reserved by them.

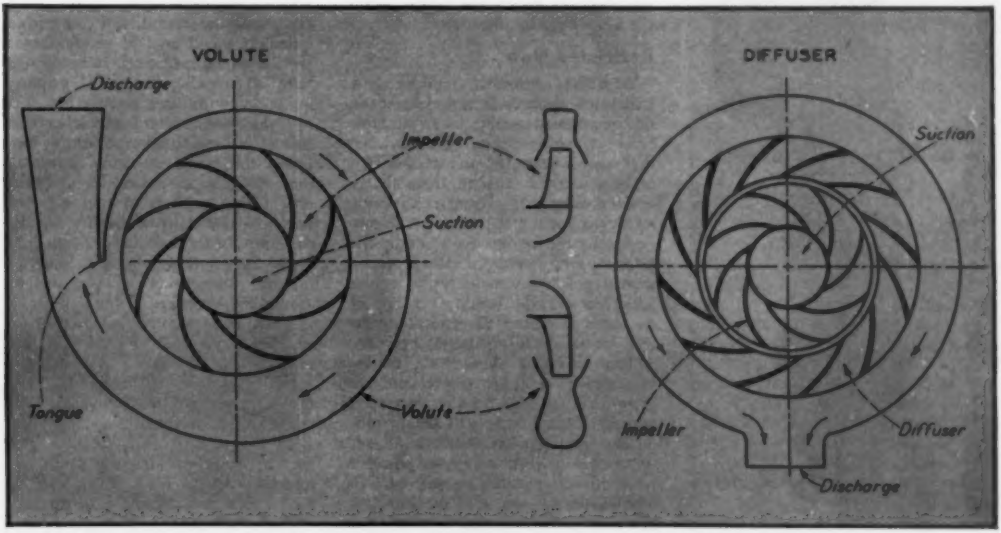


Fig. 1—The volute-casing pump derives its name from the spiral-shaped casing surrounding the impeller, which collects the liquid discharged

Fig. 2—The diffuser-type pump gets its name from a series of vanes around the impeller

able improvement in the efficiency obtainable with the rather crude volute forms in the early days of centrifugal-pump construction. Later improvements in the hydraulic design of impellers and volute casings made the use of a diffuser of little, if any, value in increasing pump efficiency. It is therefore seldom applied to a single-stage volute pump, although it possesses structural as well as hydraulic advantages, which may become useful in certain specific cases. One advantage of such a construction is that it balances radial reactions on the rotor.

Diffusion-Vane Application

At the present time, except for certain high-pressure, multistage-pump designs, the major application of diffusion-vane pumps is in vertical turbine-type pumps and in single-stage, low-head propeller pumps, as Fig. 3.

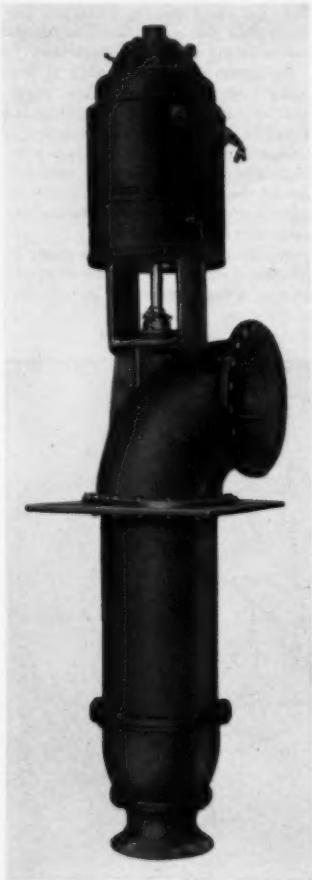


Fig. 3—Low-head propeller pump is arranged for discharge above ground

Fig. 4—Volute pump radial thrust can be combated with twin-volute design

On the negative side of the ledger, the use of diffusers may introduce certain complications in connection with the hydraulic characteristics of a pump. A diffuser having a series of fixed vanes in the path of the fast moving liquid leaving the impeller, can only meet this flow without shock at the capacity for which the pump is designed, for only at this condition does the angle of the vanes correspond to the angle at which the liquid leaves the blades of the impeller.

Restricted Flow

At all other flows, the multiple vanes will cause shock and turbulence, and the pump may operate in an unstable condition. As a matter of fact, when the flow is restricted to as low as 5 or 10% normal capacity, these shocks and turbulences may become sufficiently severe to reduce the total head generated by the pump. As a result, the head-capacity curve of low specific-speed-type pumps could easily acquire a "droop" in the vicinity of shut-off capacity, rendering the pump unsuitable for satisfactory parallel operation.

The foregoing should not be interpreted to indicate that a diffuser pump used for high-head services, such as boiler-feed pumps, will always produce a drooping characteristic. Instead, the danger of such a curve is inherent with this design and extreme care is required in the layout of the impeller and diffuser combination to avoid this particular danger.

Pump manufacturers have endeavored for a long time to stabilize the head-capacity curve of diffuser-type pumps, and various solutions are available to this end — solutions that are based on the selection of suitable impeller vane angles, proper curvature of the impeller blades and careful design of the diffuser passageways.

An additional problem arises through the use of diffusers in connection with the potential flexibility of a given centrifugal pump. It is obvious that it is desirable to obtain as much coverage from a single pump pattern as possible, so as to decrease the number of patterns comprising a complete line of pumps, and to reduce the number of parts to be carried in stock.

Volute Pump Inlet

In the case of a volute pump, it is possible to decrease the impeller diameter by as much as 20% from its maximum without appreciably reducing the pump efficiency through increased hydraulic losses. On the other hand, such a decrease in impeller diameter is unthinkable in connection with diffuser-type pumps, as the gap between the impeller periphery and the inlet vanes of the diffuser would become too great, and the hydraulic losses would grow out of proportion. As a result, the maximum-diameter impeller can only be cut from 5 to 10% at the most before it becomes necessary to utilize a different diffuser pattern with a smaller inlet-vane diameter.

Increased Inventory

These restrictions upon the permissible cut-down lead to a necessarily increased inventory and, at the same time, limit the flexibility of constructed units since a change of conditions of service, which might otherwise be met with an impeller cut-down, may require a new diffuser as well.

It has been mentioned earlier that the use of the diffuser-type casing eliminates the radial reactions acting on the rotor. These reactions in a volute-type casing arise from the fact that there is a certain inequality in the pressure distribution along the periphery of the volute because of the unsymmetrical disposition of the latter around the impeller.

Thus, hydraulic reactions are set up in the pump that are of different magnitude at various points around the impeller, and the resulting unbalanced force is transmitted to the shaft. At reduced capacities, the area of the volute is no longer correct for the flow, and the hydraulic-reaction unbalance is magnified so the force acting radially on the rotor may become quite marked.

The radial thrust is definitely a function of the head generated by the pump

(Continued on page 132)

FIGHTING CORROSION

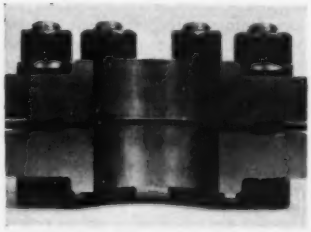
MARSHALL E. PARKER,
Consulting
Corrosion Engineer

Special machines prepare large pipes and apply coating material automatically in a continuous spiral wrap

Always consider corrosion protection in the early stages of planning because the application of control measures to a completed structure is always more expensive than its inclusion in the original design

THE RIGHT TIME to initiate corrosion-control measures on plant equipment is early in the planning stage. Preliminary plans and specifications should be checked and inspected, not once, but several times—and from several points of view. It is helpful if the checks are made by different individuals, each an expert in his field, and together having experience and ability in a set of fields covering all influences, which will bear on the completed structure.

It is their joint task to make necessary corrections and revisions while they can be made on paper — where change is cheap—instead of on the job, where it can be very expensive. The specialized point of view, which foresees the probability of corrosive attack on buried metallic structures, is frequently overlooked in this process, largely because of the emphasis on more immediate problems.



Where the metallic circuit of a pipe must be broken use insulated flange

Most common failing is not that of ignoring or forgetting underground corrosion entirely. It is the adoption of "standard" or "formula" solutions and specifications to cope with a problem that is anything but standard in its ramifications. Protective measures that have proven adequate in one location may be grossly inadequate in another; the statement of such an obvious truth would be considered superfluous if numerous examples did not show that just that error is made quite frequently.

The method of adopting apparently satisfactory measures often leads to some astounding inconsistencies within a single plant. The several systems of piping, having widely different functions, are designed by different groups of engineers. This may result in specifications that call for high grade—and expensive—coating on one run of piping, with a different line buried alongside in shameful nakedness and embarrassing proximity.

The difficulties involved here are two-fold; (1) if one run of piping needs protection, the other does likewise; (2) any later application of cathodic protection to the system will be greatly complicated by the disparity in current demands of the two sets.

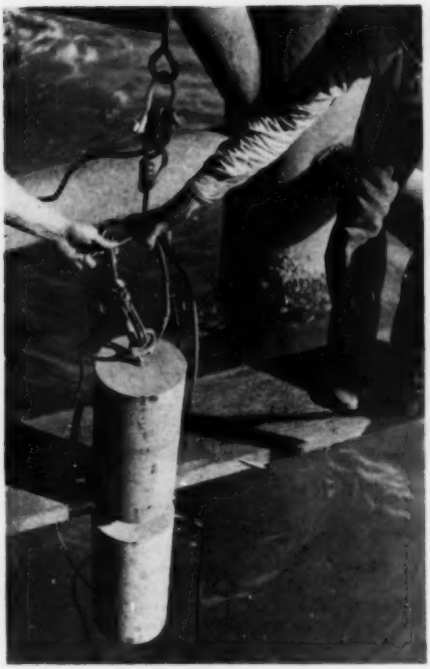
The most direct solution for this state of affairs is to make certain that *all* plans and specifications come under the scrutiny of an able and experienced corrosion engineer. This individual may be a member of the engineering staff, or may be retained for the project. He will (1) draw upon his knowledge of soil conditions at the proposed site, or make a survey, (2) suggest changes in coating specifications if needed, or recommend the really adequate protection of a thinner walled pipe than had been originally planned, and thus save a considerable sum on the over-all cost of the project.

Additional Recommendations

Other recommendations may be (1) the installation of insulating joints, to segregate the plant into units that can be protected separately at lower costs, (2) numerous minor and apparently insignificant rearrangements of components, which will greatly facilitate the application of cathodic protection and finally, (3) he may design a complete cathodic-protection system, which will maintain the physical integrity of the underground system for an indefinite period, at far lower total cost than periodic replacements and repairs.

Calling in a corrosion engineer after trouble has developed is hindsight. He can arrest the attack, but metal already lost cannot be replaced. And, in the vast majority of cases, the existing plant can not be protected except at costs considerably higher than would have been involved if protection had been included as a part of the original design, or at least had been anticipated. Much of the cost of cathodic protection can be saved by a few simple precautions taken at the design stage, even if installed much later.

Consulting the corrosion engineer



Permanent rectifier installation for the cathodic protection of tank bottoms and buried piping in a large storage-tank farm

Two fifty-pound magnesium anodes being lowered into the water to protect the submerged steel parts of an offshore drilling rig

before actual construction can still be hindsight if the planning has reached a stage where it is inflexible—if materials have already been ordered, and contracts let. Here again he may find himself forced to design a system that may cost ten times as much as it would if the plant had been designed with cathodic protection in mind. None of these ratios are mere guesses—they are all based on actual conditions encountered and dealt with in the field. A few examples will show what I mean.

Gasoline Bulk Plant

The Uninvited Guest. While a gasoline bulk plant was under construction, a contract was let calling for cathodic protection of the buried gasoline lines. These were well coated and wrapped, and had been carefully insulated where they crossed the plant boundary. Nevertheless, to protect these lines, it was also necessary to protect the electrical conduit, because the two were inextricably interconnected, at each of several motor-driven pumps and remote-controlled valves.

The contract was modified accordingly, and the installation made without undue difficulty. The conduit system was totally bare, and the coating on the lines was of a type, which experience has shown may be expected to be about 1% bare equivalent. It is, therefore, reasonable to compute that the conduit—smaller in diameter, and totalling about one-tenth of the footage—required about five times as much current for protection as the pipe itself. Thus, the uninvited guest consumed five-sixths of the feast.

The story might easily have been much worse. In the same plant there was a large footage of six-inch bare cast-iron water main. This, too, was to be omitted from the protected system, but a two-inch lateral from the main entered a steel building, where it was suspended from the roof trusses. Solidly bolted to the same steel framework were numerous electrical conduits, thus effectively tying the cast-iron water main to the gasoline piping. And the total area of the water main was about twenty times that of the conduit, not to mention the fact that it was connected to a city main of undetermined diameter and length!

Fortunately, it was possible to separate the conduit in this building from that in the remainder of the plant by installing a separate ground, but there exists the very real possibility that some electrician may tie them together at some future time without the slightest inkling of what he is doing to a cathodic-protection system.

Four Miles of Piping

The Secret Passage. This plant had about four miles of piping and two large tank bottoms cathodically protected. Before conducting a test to determine current requirements, it was necessary to isolate the plant electrically from other structures, particularly a large tank farm just across the road.

There were fourteen pipes of various kinds and sizes crossing the plant boundary line, and each of these was insulated by sleeves and washers in a flanged joint located at or near the boundary. All the joints were tested and found to be insulating properly, so the equipment was moved in and set up for the test, which was expected to require a single day.

The drainage of quite a large amount of current failed to bring anything, except piping in the immediate vicinity of the test set, up to protection. It was soon decided that a connection of some kind existed with the tank farm across the road. Tracking this down used up two days, and two weeks elapsed before the condition could be remedied.

Here is the trouble as found. A two-inch gas line and three-inch by-pass crossed the road in a common casing. This fact did not show up on the system blue prints. Both lines were coated. The gas line was insulated at the meter

inside the plant, while the by-pass line was insulated in a valve box just across the road, *outside* the plant.

Both insulating joints were effective, but they were nullified by the fact that both lines were short-circuited on the casing; probably because the coating had been scraped off when putting the lines in place. A potential difference across the joint at the gas meter was obtained because the metallic connection between the two lines inside the plant was rather remote.

More than fifty potential readings were taken (remember there were twelve other known lines, any one of which might have been the culprit) before this trouble was located. And finally, it was necessary to shut the plant down to install another insulating joint before the testing program could proceed.

Bare Casing

Casing Blues. A rather common situation is that of a bare casing short-circuited on a well-coated line. An eight-inch line, fourteen miles long, had an excellent coating job, equivalent to ½ of 1% bare pipe; the total equivalent bare area of the entire line was thus 765 sq ft.

There were three road and railroad crossings, all cased. Two of these were in good condition; the third was short-circuited to the pipe line. This particular casing consisted of 120 feet of totally bare ten-inch pipe, having a total area of 337 sq ft.

It was necessary to supply almost one-third of the total current used on this system to protect this casing; not particularly because it needed protection, but because it touched the pipe electrically. One could not be protected without protecting the other. The cost of separating them would have been greater than the cost of the additional protection needed; but the cost of keeping them separate in the beginning would have been quite small.

Although such illustrations show what not to do, they leave unanswered the questions of what positive steps to take to insure the maximum effectiveness of protection, or the degree of protection that will yield the maximum economic return. As stated previously, best solution is to utilize the ability and experience of a competent corrosion engineer. But there are some guiding principles that lead to positive steps, which, if taken, will return large dividends in savings.

First, it must be realized that most soils are corrosive to most metals. They differ widely in corrosion rates, but the soil that will not attack bare metal is rare. And, even where the rate of attack is so low that no failures are experienced during the useful life of the material, the increased salvage value of well-protected pipe may justify the whole cost of protection during twenty or thirty years of life. At any rate, this possibility should be investigated.

Second, it must be realized that there will be bare metal. The most conscientious manufacturers of coating materials do not claim their products alone will arrest all corrosion, when the installation is such that inspection and maintenance is impossible—as is the case with buried structures. What a good coating can do is to cut down the amount of cathodic protection to as little as 1% needed by a bare structure.

This seems to be about the point of maximum return; better coating could only shade 99% effectiveness a little closer to 100%, and the most that a perfect coating could save would be cost of cathodic protection of the 1%.

It must also be realized that to be protected, a metallic structure must be electrically isolated from all other structures whose protection is not desired. Of equal importance, the whole system of metal to be protected must be an electrical unit, solidly bonded together. Almost invariably, all the piping within a given plant is inextricably interconnected electrically, although it may comprise dozens of difference systems handling different fluids. It will also be connected to most of the other metal structures within the area.

Electrical Isolation

This condition means that the only reliable way to isolate such a plant from outside loads on the cathodic-protection system is to throw a cordon around the entire area, and interrupt the electrical continuity of every piece of metal crossing that line. It is not wise to have long "fingers" of outside metal extending within the plant, and usually better not to have long extensions of inside metal reaching outside the area.

Unprotected structures in proximity to those under protection are frequently damaged by stray currents, originating in the protection system, wandering on and off at unknown points. There is also danger of accidental short-circuits like those cited, and they can be exasperatingly elusive.

Because of this stray-current effect, it is unwise to attempt the protection of only a portion of the buried metal. Consequently, it is preferred practice to coat and wrap all buried piping, regardless of its material, and to coat such other metal surfaces—such as tank bottoms—wherever it is practical.

Metal encased or imbedded in buried concrete is subject to corrosion and to stray-current damage. This has been known to cause failure of the concrete by the expansion of the corrosion products formed. The inclusion of such metal in the cathodic-protection system is strongly advised, and it may involve some bonding (usually by welding) to establish electrical continuity.

Small lines and those too short for machine wrapping can be hand wrapped

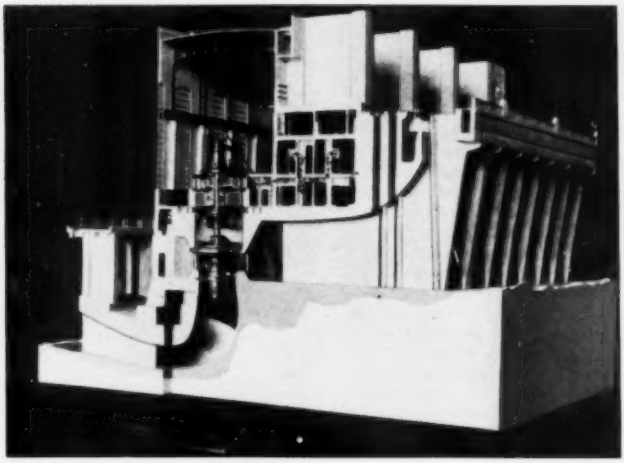
As a final word of caution, it is absurdly easy to overlook metallic connections, which should be perfectly obvious. This is particularly true in large projects, where different groups of structures are handled by separate departments or organizations, because of differences in their intended functions.

Each group of engineers concerns itself with its own set of facilities. Separate and often uncorrelated maps and diagrams are set up, and there is frequently no single appraisal of the whole plan from the viewpoint of corrosion and cathodic protection. But when these different facilities are buried together, the soil does not recognize their different functions and nature treats them for what they are.

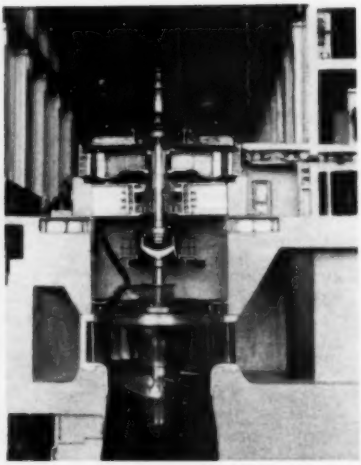
Galvanic currents set up by different metals, different soils, different degrees of moisture, and a host of other conditions, will flow wherever they find convenient paths, without regard for the intentional or accidental reasons for the existence of these paths.

ACKNOWLEDGEMENT

Photos courtesy of Caterpillar Tractor Co; F. H. Maloney Co; Cathodic Protection Service; Brance-Krachy Co; and Minnesota Mining & Mfg. Co.



Model above shows how a hydroelectric plant looks if you slice it at the centerline of a unit. It requires about twelve manhours to open a turbine



Man swinging on boatswain chair drained leakage water from valve in nose of hub

BLADE-TRUNNION SEAL RINGS THAT KEEP

A CASE HISTORY: How engineers tracked down the right material and the correct design for a tough packing job. Objective was a packing to hold against a constant oil head and variable water pressure

PAUL M. HESS,
Ass't Supt of Operation,
Pennsylvania Water & Power Co.

THE ILLUSTRATIONS at the top of these pages bring you closer and closer to the *blade seal ring* of a "Kaplan" hydraulic turbine. The drawings across the top of the third page show step by step how the original, unsatisfactory seal ring has been changed and improved over the years. It is a case history of engineering detective work.

To get oriented, look first at the illustrations above. You are at Safe Harbor, a big hydroelectric plant on the Susquehanna River in Pennsylvania. The first picture shows a cross sectional model of the dam and power house. Upstream side of the dam is on the right—water flows from right to left. You can see the watercourse on the model. It funnels in to the turbine, pours down over the blades, then down and out to the left into the tailrace below the dam.

In the second picture, which is a closeup of the same model, you can see the principal parts of the turbine itself. Starting at the bottom, the main rotating elements are the bullet-shaped "hub," the five blades held by the hub, the vertical shaft, which is driven by the hub, and the generator.

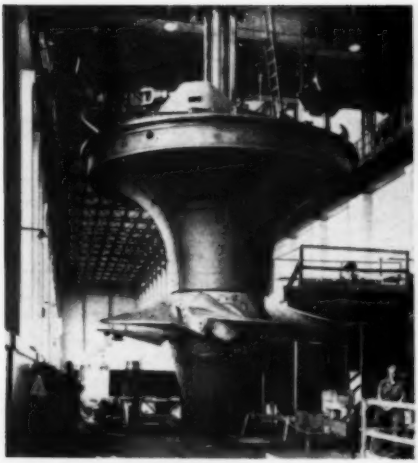
Non-rotating components are the scroll case, which circles the turbine and distributes water to all sides of it; the wicket gates, which regulate flow of water from scroll case into the turbine; and the flared-out head cover over the hub. The action: water enters from the right, flows around the scroll case, through the wicket gates and down over the blades. The blades turn the hub, and the hub drives the shaft and the generator above.

Giant Blades and Hub

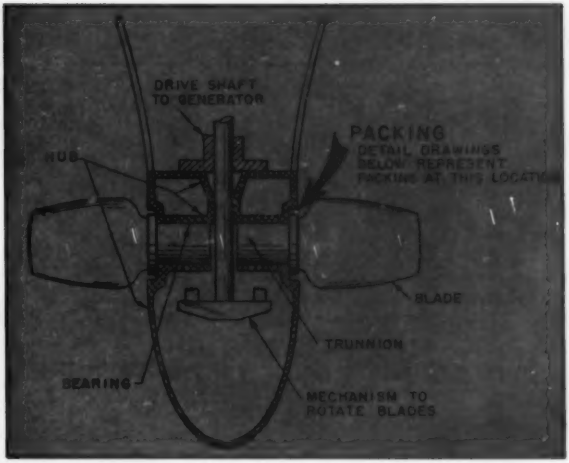
A closer view of the hub and blades, and an idea of their great size, is afforded in the third photograph, which shows an actual turbine in the process of assembly and installation. The hub is the bottom-most component, extending upward only as far as the black horizontal line visible in the photograph just above the blades. The flared component above the black line is the non-rotating head cover. Our chief concern is with the blades and the hub that holds them.

The distinguishing characteristic of the Kaplan type turbine is that its blades are variable pitch. Power output of the generator is made to rise and fall with demand for electricity by varying the wicket gate opening, and as the gate openings change, the pitch of the blades automatically changes to maintain the most efficient use of the water. The blades can be tilted from a near horizontal position to an angle of 30 degrees. When they are near horizontal, they exert practically no torque and generate very little power; when they are at 30 degrees, broadly speaking, they exert maximum torque and generate maximum power. In operation, the blades are changing pitch almost constantly, tipping back and forth in a definite relation to gate opening to conform with fluctuating demands for power or speed regulations.

The drawing at top right shows how pitch variation is accomplished. Each blade has its own trunnion, which is supported by bearings inside the hub. All trunnions are connected to a system of links and levers, which, when actuated from above by a push-pull rod, turn the trunnions and thereby change the pitch of the blades. (In the interest of simplicity, this link-and-lever system has been omitted from the sketch, except for the push-pull rod and the spider at its lower end.) To



Neglecting centrifugal force, static oil-head pressure on packing equal to three feet above headcover



Although not shown in this view, a false bottom directly below crosshead has drain line leading to hub nose from which water is drained

OIL IN, WATER OUT

lubricate the trunnion bearings and the mechanism that changes blade pitch, the entire cavity of the hub is filled with oil—900 gallons of it.

Oil In—Water Out

Which brings us to the central figure in our drama—a big, 36 in. diameter packing ring around the blade trunnion in the sketch above. Purpose of the packing is to seal the hub—keep oil in and water out. It is held in place by a retaining ring bolted to the wall of the hub.

This retaining ring is too small to show in the sketch, but one of them is visible in the third photograph and around the blade trunnion where the trunnion enters the hub. It shows in the photograph as a narrow ring with a circle of bolt holes at its outer edge. Our cantankerous packing is directly behind this retaining ring.

Perfect Performance

Today, the packing serves flawlessly, but it was not ever thus. In the six drawings across the top of the next page are charted the progressive improvements. They depict the same cross section as that of the drawing at top right but show construction details at the location indicated by the big arrow. Thus as you look at each drawing, the interior of the hub will be off the print to your left, the blade to your right. The left side of the packing is exposed to oil, the right side to water.

The first of these drawings (sketch 1) shows the original packing. There are seven turbines at Safe Harbor (each 42,500 horse power), and this design was supplied with the first six that were installed between 1931 and 1934. The packing rings were made of leather and never effected an altogether satisfactory seal, primarily because they took a permanent set.

Corrosive Action

Leakage was aggravated by the fact that the contact surfaces of the trunnions were roughened by corrosion and pitting from cavitation and, as the trunnions turned back and forth with changing blade pitch, the nonresilient packing was unable to maintain sealing contact with the irregular surface. In-and-out leakage frequently amounted to as much as 25 or 30 gallons a day on some of the units. Loss of so much oil was expensive and required constant vigilance.

Even more alarming was the danger that inleakage of so much water would cause serious corrosion of the mechanism inside the hub. Fortunately, no corrosion took place on any of the hub mechanisms, probably because the oil was one of the finest grades available and had a high demulsibility factor.

During the early, troublesome years, it was necessary to check the oil levels in the hubs constantly, bring them to the full mark, and when records showed that inward leakage had reached 300 gallons, take the machine out of service to drain the water and refill the hub with oil. It was a lucky month when the maintenance gang did not have to descend into a turbine pit to repair or replace the blade packing on one or another of the six turbines.

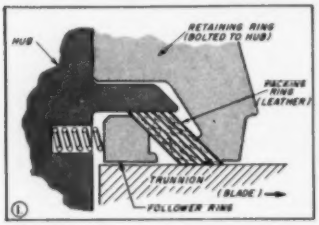
Sketch 2 shows the first attempt to remedy the situation. Seal rings were made of neoprene rubber in the same shape as the leathers. Neoprene, then in its infancy, was chosen because of its resilience and oil resistance. The first set of these rings was installed in the summer of 1939 and during the warm weather they were fine, even on badly pitted contact surfaces. They did not, however, function properly in winter, when the water temperature dropped to freezing. At this low temperature the material stiffened and lost some ot its resilience; the follower ring lifted the heel of the packing ring and it no longer gave a tight seal against a rough contact surface. However, neoprene's superior performance at normal temperatures justified the expenditure of effort and ingenuity to overcome its one deficiency.

Remedy and Redesign

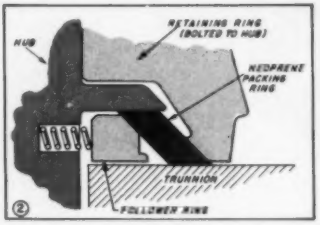
Sketch 3 shows the remedy—redesign. The lip at the bottom of the follower ring was machined off to form a V-shaped face, and the rings were made with a new cross sectional shape. With the old shape, pressure of the follower ring tended to lift the bottom surface of the packing away from the trunnion.

With the new design the follower ring presses the packing down against the rotating trunnion surface, and at

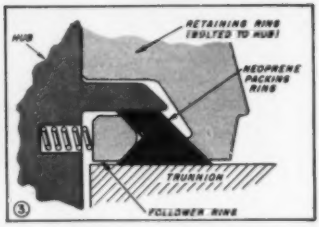
FIRST CHANGES IN PACKING DESIGN



Original packing consisting of laminated leather ring was not resilient enough

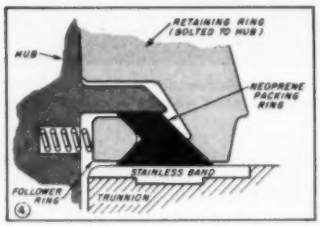


First neoprene ring was the same size and shape as the leather, but solid

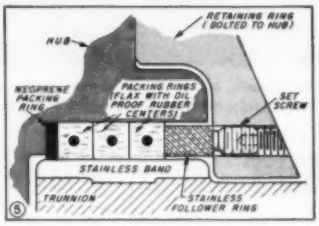


Next refinement was to change cross-sectional shape of ring and follower

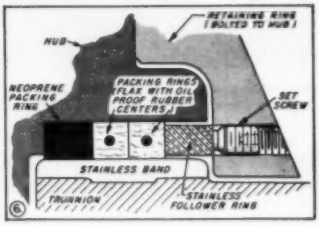
ADDING STAINLESS STEEL TO THE TRUNNIONS



Adding a stainless-steel band to the trunnions stopped corrosion pitting



New turbine came with this design of neoprene and flax packing, but . . . .



. . . . it was not resilient enough so a neoprene ring now replaces inner flax

the same time against the stationary surface of the hub. Neoprene packing of this modified chevron design has proved entirely satisfactory and is used now, just as shown in sketch 3, on five of the turbines.

Leakage is nil in cold weather as well as warm, despite the fact that some of the trunnion contact surfaces are quite rough. Actually there has been no absolute necessity to go beyond this point in the evolution of the packing, but we have made some beneficial innovations in the process.

Introduction of Stainless

One of them, the use of stainless steel, is illustrated in sketch 4, which differs from the third sketch only in the addition of a stainless ring. It is shrunk on the trunnion to provide a good contact surface for the packing; its hardness and toughness resist the blows of cavitation and thereby maintain a smooth surface. Although the packing ring seals satisfactorily against a rough trunnion, the stainless ring is considered worth while as an insurance measure. Stainless rings were specified in the design of the two most recently installed machines.

On the five machines installed earlier, which were not equipped with stainless rings, roughened trunnions are gradually being improved by rebuilding pitted areas with welded stainless steel. It is, incidentally, only within the last few years that stainless could be used to rebuild pitted trunnions. Ordinary steel had to be used because no power tool capable of finishing stainless welds was obtainable that could operate in the narrow space available. Then, a few years ago, special grinding tools were developed for the job, and since then stainless has been used exclusively.

Sketch 5 shows the newest turbine, the seventh to be put in operation. It was installed in 1940, six years after the last of the original six. It is apparent that the turbine manufacturer has used an entirely different design for the blade packing. This design called for an eighth-inch thick ring of neoprene on the oil side of the packing; and on the water side, three rings of woven flax, square in cross section and having oil resistant rubber centers.

Follower Spring Omitted

It will be noted that the follower spring was eliminated—the designers assuming that the resilience of the packing assembly, supplemented by set screws to permit readjustment, would be sufficient to maintain sealing pressure as the rings began to wear. However, the packing had too little resilience to be entirely satisfactory.

Resilient Seal

The problem on this turbine has been solved as shown in the sixth and final sketch. One flax ring has been removed and replaced by a neoprene ring, which imparts sufficient resilience to maintain a tight seal during the interval between regular inspections—these regular inspections being the only times when the set screws can be tightened without inconvenience and lost time.

Since the change was made five years ago, leakage on this turbine has been negligible and it has been necessary to adjust the set screws only once during the eleven years of service. The design used on this newest turbine appears to be as good as the modified chevron packing on the six older machines (sketch 3 or 4)—but it enjoys no particular advantage over the older design.

Looking back, we at Safe Harbor feel that our detective work has paid handsome dividends. Where oil leakage had been very wasteful, it is now of a negligible quantity. Where maintenance work on the original seal rings had been a constant thorn in the flesh, neoprene rings are now put in and forgotten for many years. Finding the right material and the right design took time and effort, but the results are worth it.

KNOW YOUR GEAR REDUCTION FACTORS BEFORE SELECTION

- Appraise reduction gear units from recommendations of the American Gear Manufacturers' Association
- Consult the manufacturer's tables for their service factors under the specific load conditions
- Determine unknowns carefully from data already on hand and select unit with sufficient capacity

R. A. MOLLER, *Associate Editor*

FROM TIME to time the plant engineer is confronted with the problem of selecting a speed reduction for a power transmission unit. The first appraisal, of course, is the service classification into which it falls. By way of assistance, the American Gear Manufacturers' Association has set forth the following service classification recommendations when selecting gears.

Classification 1 covers normally eight to ten hours of service, free from recurrent shock load that occurs at even and frequent intervals. Class 2 covers eight to ten hours service where recurrent shock load is encountered, or twenty-four hour service where no shock load is experienced, and the service factor is 1.2. Class 3 is designated as twenty-four hour shock load service. For applications to this service classification, the mechanical ratings listed in the usual manufacturers' tables must be divided by a service factor. This service factor has been determined to be 1.3. In addition, the thermal rating must not be exceeded. Class 4 embraces intermediate service, where the worm is operated at speeds of 100 rpm or more. The mechanical ratings in the usual manufacturers' tables must be divided by a factor indicated in Table 1. The value depends upon the frequency and duration of the load.

Class 5 applies to those applications where the worm speed is less than 100 rpm. For application to service in this classification, maximum output torque ratings, offered by the manufacturer indicate the rated capacity independent of the nature or duration of the load. Where the service is intermittent, the factors appearing in Table 1 must be applied.

In transmitting mechanical power through a speed reducer, neglecting small losses due to friction, the horsepower remains constant and the torque increases in the same ratio as the speed is reduced. To determine the horsepower required to drive a machine, it is sometimes necessary to ascertain the torque needed to operate the driven shaft and the speed of this shaft.

Converting of torque and speed to horsepower may be accomplished by means of the following formula:

$$hp = \frac{P \times R \times rpm}{63{,}025}$$

Where: P, force or weight in pounds
R, radius at which force or weight is applied in inches
rpm, shaft revolutions per minute.

Overhung load capacities for both input and output shafts are listed in manufacturers' catalogs, such as Table 2. These values give the maximum radial load that can be applied to the shafts. Determination of these data is based on the load being applied at the midpoint of the standard shaft extensions. The load is usually in the form of a pull due to a chain on a sprocket, a belt on a pulley, the tooth pressure between a pinion and gear or a weight such as carried by a hoisting drum.

In order to calculate the applied overhung load, the torque at the shaft on which this load is applied must first be determined. This may be accomplished by transposing the formula given for horsepower. In solving for torque this formula is then employed:

$$T = \frac{hp \times 63{,}025}{rpm}$$

Tangential force on the overhung member may then be found by dividing the torque (T) by the pitch radius (R) of the overhung member. For a chain reduction the tangential force calculated in this manner is the actual overhung load. However, when the overhung member is a pinion or belt pulley the actual overhung load is greater than the tangential force. This results from the separating force between gear teeth or initial belt tension required.

For such auxiliary reductions the approximate overhung load may be determined by multiplying the tangential force by a suitable factor taken from the following: spur pinion—1.25, V-belt—1.5 and flat belt—2.5.

Selection of bottom or top drive reducers depends primarily on the arrangement of driving and driven equip-

TABLE 1 — WORM GEAR SERVICE FACTORS

Multiple cycles per hour	One cycle per hour	One cycle per two hours or more	Service factor
—	5	10	0.6
2	10	20	0.7
5	15	30	0.8
10	20	40	0.9

TABLE 2 — OUTPUT SHAFT—TYPICAL OVERHUNG LOAD CAPACITIES

Shaft speed	Unit size														
rpm	30	35	40	50	60	70	82	92	102	122	135	155	180	200	
400	550	1000	1400	2000	2200	2300	2600	4000	4100	4300	8400	10000	12000	13500	
300	600	1000	1400	2000	2300	2500	2800	4200	4300	4500	8400	10000	12000	13500	
200	650	1000	1400	2000	2700	3000	3400	5000	5200	5500	8500	10000	12500	13500	
100	850	1000	1400	2000	3000	3600	4000	6000	6200	6400	8600	10000	13000	14000	
50	900	1500	1400	2000	3000	4200	4500	6200	6400	7000	9000	10000	13500	14500	

ment. The top drive type is limited in application by worm speed. If the speed is less than 600 rpm there might be some danger that the worm bearings will not be positively lubricated. On the other hand the same condition may exist for very high gear rim speeds. For these reasons the bottom drive type is generally applied where the arrangement of equipment does not preclude its application.

Typical manufacturers' thermal ratings are listed in Table 3. They are the maximum input horsepower, which may be transmitted without causing excessive temperature rise in the oil reservoir. The limit of temperature rise upon which these ratings have been based is 100 F above ambient. Thermal ratings are determined by the radiating qualities of the gear casing. Therefore, the ratings listed should not be applied to reducers other than the specific manufacturer's ratings.

Thermal ratings must be taken into consideration for serivce classifications 1, 2, or 3. If the power transmitted exceeds the thermal rating the full mechanical rating may be carried by equipping the reducer with water coils.

Manufacturers of gear reduction units have compiled similar rating tables. These tables comprise data that they have compiled through actual and accurate tests on their equipment. The simplest way of applying these various tables is by a typical problem. For example, assume that a vertical worm reduction is to be selected to drive an agitator by means of a direct coupled arrangement. The following conditions exist: (1) the motor has a capacity of 10 hp and operates at 1150 rpm, (2) the agitator speed is 40 rpm, (3) the downward thrust load due to the weight of the agitator and hydraulic thrust is 4500 lb and (4) the service classification is 24 hours per day with no shock load.

In solving this problem the first step is to determine the approximate ratio required, and this is 1150 divided by 40 or 29. The service classification is Class 2, and the service factor is 1.2.

By referring to Table 3 it is found that a typical reducer, having a ratio of 30, has a Class 1 rating of 13.8 hp at 1150 rpm input speed. As the service classification in this problem is Class 2, and the service classification for the table is Class 1, the 13.8 hp must be divided by the service factor of 1.2, which gives a horsepower rating of 11.5. The thermal rating of 12 hp for this ratio is not exceeded by the actual power transmitted.

Having established that this reducer is of suitable size to transmit the horsepower, the downward thrust capacity should be checked. By referring to Table 4 it is found that the thrust capacity of this reducer, with output speeds less than 50 rpm, is 10,000 lb.

In a second problem, to further emphasize the use of manufacturers' tables, assume a worm gear speed reduction is to drive a hoist drum. A chain reduction will be provided between the reducer output shaft and the drum shaft. The following conditions will hold; the motor is to operate at 575 rpm, with the horsepower to be determined. The drum radius from center of drum to center of rope is 8 in., rope pull is 1900 lb and drum speed is 10 rpm. The chain reduction is at a ratio of 2.3 to 1, and the pitch diameter of the sprocket mounted on reducer output shaft is 5 in. Service application is intermittent with 5 or 6 cycles of operation per hour with no more than 8 minutes of operation.

Reducer output speed is first obtained by multiplying the drum speed by the ratio of the chain reduction. This is 2.3 times 10 or 23 rpm. The approximate ratio required then is 575 divided by 23 or 25. Torque at the drum is the product of the rope pull and the radius from the center of the drum to the rope centerline. This is determined to be 1900 x 8 or 15,200 in.-lb. This figure divided by the ratio of the chain reduction, produces the torque at the reducer output shaft and is 6610 in.-lb.

Horsepower to be delivered by the reducer is found from the horsepower formula and resolves itself into 6610 x 23 divided by 63,025 or 2.41. The horsepower input at the reducer is determined by dividing 2.41 by the efficiency of the gearing, and this is 0.875. Therefore, 2.41 divided by 0.875 gives 2.75 hp. A 3 hp motor may be used to supply the necessary power.

Service classification for this application is determined to be 4. The table of service factors for intermittent operation indicates that the proper factor for this application is 0.9. Referring to Table 5 shows that the Class 1 input horsepower rating for a typical reducer with a 25 to 1 ratio to be 2.7. Dividing this value by the service factor of 0.9 gives a Class 4 rating of 3.0 hp, which meets the requirements.

Chain pull, overhung load, is determined by dividing the torque at the reducer output shaft by the pitch radius of the sprocket. This becomes 6610 divided by 2.5 or 2650 lb. Referring to Table No. 4 it shows that the overhung load capacity of the typical reducer is 2000 lb. This capacity is exceeded by the actual overhung load of 2650 lb. Therefore, a special type designed for heavy overhung load applications should be selected over the standard shaft extension.

Acknowledgement is made to De Laval Steam Turbine Co. for this data.

TABLE 3 — TYPICAL INPUT HORSEPOWER RATINGS

	Input shaft, rpm									Thermal hp	Output torque
Ratio	100	300	450	575	680	865	1150	1450	1750	Rating	in.-lb
3-5/8	11.8	24.4	30.2	34.1	36.5	40.1	44.4	48.0	50.9	48.5	26060
4-3/7	11.5	24.3	30.3	34.2	37.3	41.1	45.7	49.7	52.5	44.5	30990
5-5/6	10.3	22.4	28.5	32.1	34.9	38.9	43.9	47.4	50.7	38.5	36450
6-1/5	10.0	22.0	28.0	31.7	34.5	38.4	43.4	47.1	50.4	37.0	38080
6-5/6	9.5	20.9	26.5	30.2	32.8	36.7	41.2	45.0	48.1	35.5	39630
7-3/5	8.9	19.6	25.1	28.6	31.1	34.9	39.4	42.6	45.4	33.0	40630
8-3/4	8.1	18.0	23.0	26.4	28.6	32.1	36.4	39.8	42.5	30.5	43070
9-2/3	7.6	16.9	21.7	24.8	27.0	30.4	34.3	37.7	40.0	28.5	42510
11-2/3	6.5	14.7	18.9	21.8	23.7	26.7	30.2	33.2	35.5	25.0	45030
13-2/3	5.7	13.0	16.6	19.1	20.9	23.5	26.5	29.3	31.2	22.5	45890
15-1/2	5.2	11.8	15.1	17.5	19.0	21.4	24.4	26.8	28.6	20.5	46510
17-1/2	4.7	10.6	13.7	15.9	17.3	19.3	22.0	24.3	25.9	18.5	46910
19-1/2	4.3	9.7	12.5	14.5	15.8	17.7	20.2	22.2	23.8	17.0	46930
24-1/2	3.5	8.0	10.3	11.9	13.0	14.7	16.6	18.3	19.7	14.0	47270
30	2.9	6.6	8.5	9.8	10.7	12.1	13.8	15.1	16.3	12.0	46180
35	2.5	5.7	7.4	8.5	9.3	10.5	11.9	13.2	14.1	10.5	46500
40	2.2	5.1	6.5	7.5	8.2	9.2	10.5	11.6	12.4	9.3	44370
45	2.0	4.5	5.8	6.7	7.3	8.3	9.4	10.4	11.1	8.4	43440
50	1.8	4.1	5.3	6.1	6.6	7.5	8.5	9.3	10.1	7.6	41910

TABLE 4 — TYPICAL DOWNWARD THRUST CAPACITIES

Output-shaft	Unit size												
speed, rpm	30	35	40	50	60	70	82	92	102	122	135	155	180
400	1500	1850	3000	5000	5500	7200	8300	8500	8000	11000	6000	9000	11000
300	1750	2050	3300	5600	6200	8000	9000	9200	8700	12500	6000	9000	11000
200	2050	2400	3600	6000	7000	8500	9500	10000	10300	12500	6000	9000	11000
100	2500	3000	4500	6000	7000	8500	9500	10000	11000	12500	6000	9000	11000
50 or less	2500	3000	4500	6000	7000	8500	9500	10000	12500	12500	6000	9000	11000

TABLE 5 — OUTPUT SHAFT—TYPICAL OVERHUNG LOAD CAPACITIES

Output-shaft	Unit size												
speed, rpm	30	35	40	50	60	70	82	92	102	122	135	155	180
400	700	900	1850	2600	3750	4350	5000	6250	7200	8000	8400	10000	12000
300	750	900	1850	2600	3750	4350	5000	6250	8000	9500	8400	10000	12000
200	750	900	1850	2600	3750	4350	5000	6250	8000	11000	8500	10000	12500
100	750	900	1850	2600	3750	4350	5000	6250	8000	11500	8600	10000	13000
50 or less	750	900	1850	2600	3750	4350	5000	6250	8000	11500	9000	10000	13500

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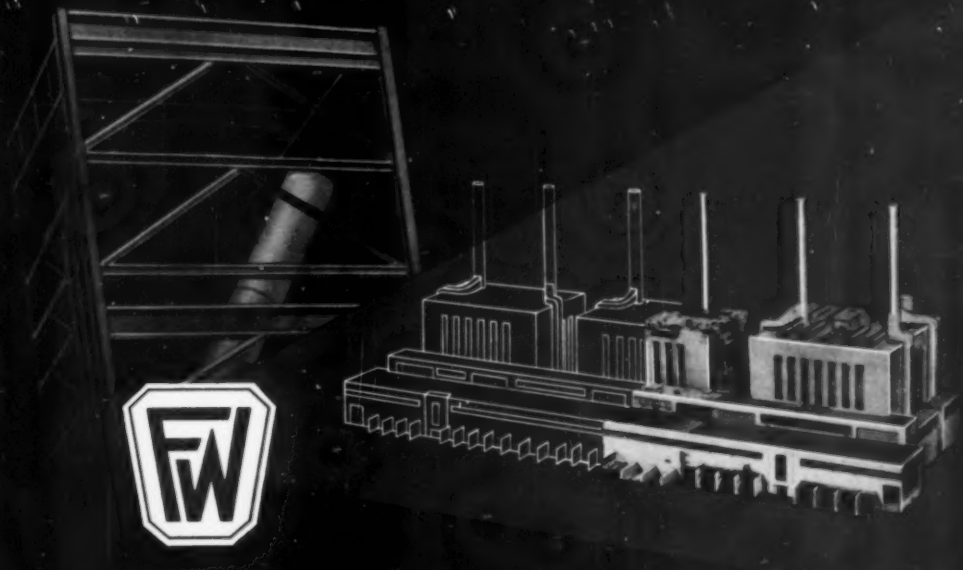

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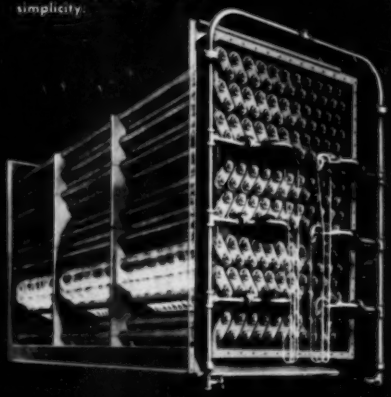

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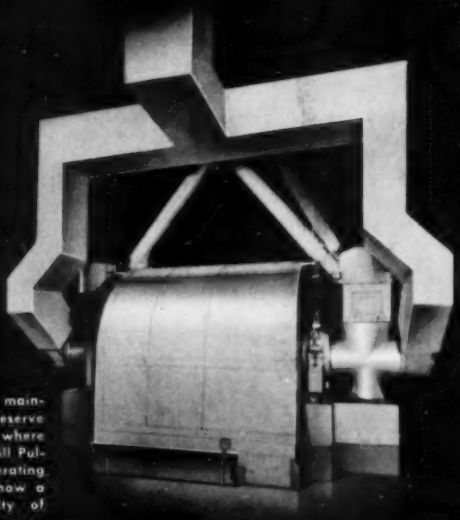

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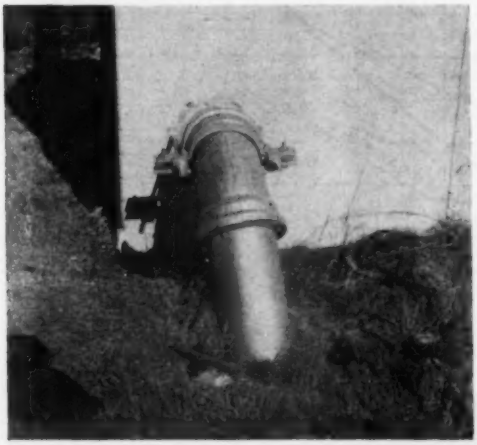
Stopping Suction-Line Leak

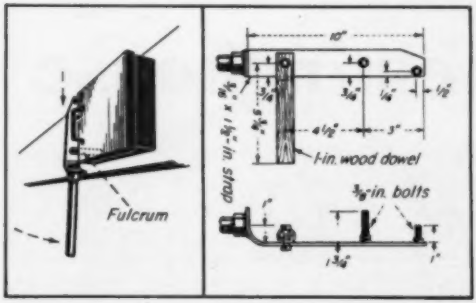
● The suction line from cooling-tower sump to circulating pump gave trouble at the upper end of the 45-degree double-bell ell used to tie the line to the pump suction just outside the building wall.

Partly due to the closeness of the bell to the pumphouse



wall, it was difficult to calk the joint properly, and any slight settlement or expansion of the line from temperature changes opened the joint and air would enter.

To remedy the trouble we stiffened the joint by putting a heavy plate inside the wall and fitting a clamp outside the upper bell. Two ¾-in. bolts were passed through the inside plate, wall and halves of the clamps. Tightening the bolts pulled the bell tightly against the packing and transfered the weight of the cast-iron fitting from the joint to the wall. With the elbow thus secured, all caulking could be done at the lower bell. *Elton Sterrett, Houston, Texas.*



Electrical Bus-Duct Opener

● This easily made bus-duct opener will be a boon to your maintenance department, because it opens line boxes without the need of a ladder. *Sketch bottom left.*

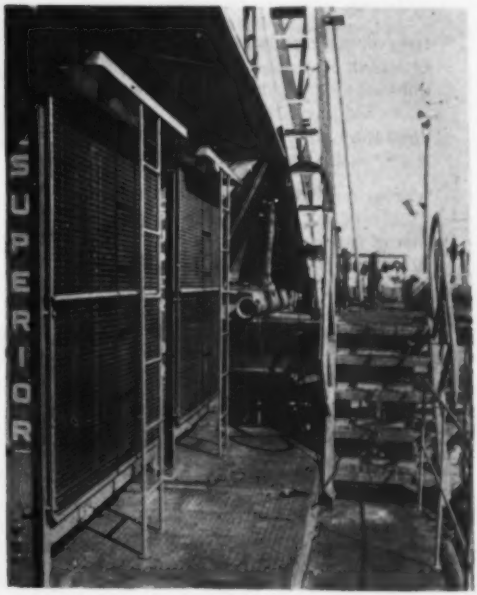
In use, the opener is placed on the box as shown. A slight downward pressure trips the latch, and a light push on the handle opens the door. Closing the door is accomplished by using the back of the opener. Right-hand sketch shows how to make the opener. *Charles Wesley Shutt, Alma, Mich.*

Ladders for Radiator Inspection

● When checking the water level in radiators too high for a man to look into, he must rely on a ladder that may be anywhere but at the engine. Water level, therefore, is apt to be noticed only when it gets dangerously low.

To provide a ready means of inspection, one engineer outfitted his units with permanent ladders that remain in front of the radiators at all times, and which make it merely a routine job to check water levels and temperatures.

Each ladder is made from steel rods, with the upper end welded to a ½ x 2-in. steel strap, which is bent and bolted to the edges of the radiator shell at the top. The lower ends pass through holes burned in the steel floor, with supporting rings being welded to the upright rods. The rings bear on the floor and the rod ends extending through the floor serve to hold the ladder in alignment. *Elton Sterrett.*



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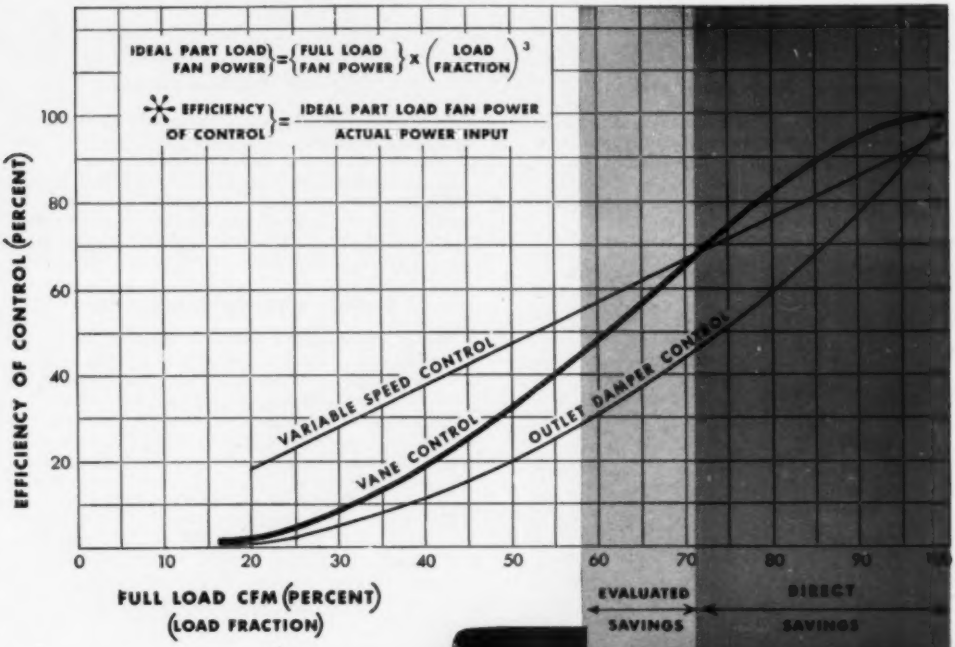

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JOBS FOR THE HYDRAULIC CONVEYER

WILBUR G. HUDSON, *Consulting Engineer*

FOR MANY YEARS great hydraulic floating dredges have been reclaiming vast areas of swamp land with material sucked from river and lake bottoms, and recently the possibilities of hydraulic conveying for industrial requirements have become appreciated. In handling ashes from large steam plants for instance, the hydraulic conveyer has striking advantages and, of course some limitations. Sketch A of Fig. 1 shows a simple emergency coal storage installation.

The existing coal handling equipment in this plant has a capacity of 20 tph. There was on hand a 500-gpm pump. A 6-in. leader pipe was rigged up on wood cross pieces, and the water was jetted in at the near end. By trial it was determined that 500 gpm would move about 10 tph of coal (more or less, depending on the length and slope of the 6-in. pipe.), so an adjustable bypass gate was provided in the chute between elevator and conveyer. The total cost to provide reserve storage, was a few hundred dollars. An essential here is a sloping ground surface and assurance that the run-off will not cause difficulties with neighbors.

An inquiry was received for a 200-ft screw conveyer with cast-iron trough, to handle screenings from the loading-out side of an anthracite coal-washing plant. Ample water at 50 psi pressure was available so, obviously, the cost of the helicoid, supports, bearings and drive could be saved. And the hydraulic installation is better because of elimination of injury to men working along the line of screen chutes.

Trains of empties are run into position and loaded, more or less simultaneously, through screen chutes, sketch C. The screenings are sluiced to the sump of a perforated-bucket elevator, and the coal de-watered as elevated for re-screening. Water flowing from the sump is sent to rejoin the coal-washing water. The volume and size of the screenings vary, so the trough is stepped at 50-ft intervals to accommodate booster jets, sketch B, and the boosting action is adjusted to take care of any contingency.

The hydraulic sluice does the job better than any mechanical conveyer. A pneumatic conveyer could be arranged, but would be complicated, costly, and require more power. It would, however, eliminate the bucket elevator.

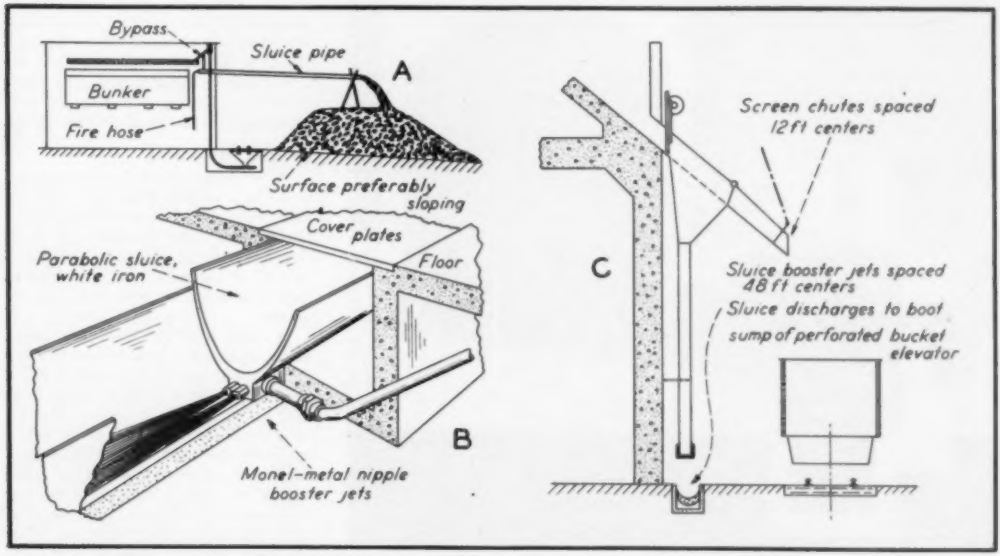

Fig. 1—The hydraulic conveyer can be used to provide reserve coal storage (A), because the coal has a chance to dry. The trough can be stepped for booster jets (B). Screenings from washing plant returned hydraulically (C).

Power requirement comparisons are interesting. Assume the problem of moving 40 tph of coal horizontally a distance of 200 ft. Without going through the details of procedure for the hydraulic conveyer the volume of coal is 1600 cu ft per hr, and the total volume of the mixture of coal and water is 17,600 cu ft per hr or 293 cu ft per min. The head loss with a 10-in. pipe is 8.8 ft in 200 ft, and the theoretical hp is:

$$HP = \frac{Q\,W\,H}{33{,}000}$$

Where: HP is theoretical or water horsepower.
Q is cu ft of mixture handled per min, 293
W is wt of mixture per cu ft, 64 lb
H is head in feet, 8.8

$$HP = \frac{293 \times 64 \times 8.8}{33{,}000} = 5 \text{ water hp or a 10-hp motor.}$$

With a pneumatic conveyer the ratio of air to coal would be 140:1 by volume, and the motor-blower would be 25 hp. For a screw conveyer we would need a 20-hp motor. As regards power, this is distinctly a belt conveyer proposition—1.0 hp for the empty belt, plus 0.5 hp for the load, a total of 1.5 hp or a 3-hp motor.

The hydraulic method is not well suited for bin storage of coal, because the coal compacts and will not flow out after the water drains off. This is no objection for reserve storage, since the small bulldozer used for reclaiming loosens up the mass after it has had ample time to dry.

Hydraulic disposal of ashes offers, among other advantages, dustless operaton and elimination of injury risks. If the layout permits direct sluicing to a disposal area, and assuming a suitable water supply and no run-off complications, it provides an installation difficult to beat, both in first cost and operating costs.

For a small plant, where ashes dribble continuously from the rear ends of chain grate stokers, a simple gravity-flow system may work nicely. A flow velocity of about 200 fpm suffices to carry along ash and clinkers to a sump, from which the water may be drained and re-circulated with the addition of make-up water.

From the sump, the material may be loaded on trucks by a small grab bucket or inclined-drag chain conveyer. At one plant so equipped, the sluice was of concrete, 12 in. deep and 24 in. wide. The pump has a rating of 600 gpm and the ashes amount to 7 tons in 24 hrs. Only part of the pump capacity is used.

In large steam plants, the ashes usually must be sluiced to a sump and pumped from sump to disposal point. Special rubber-lined pumps are available for this severe duty. If the ashes must be stored in elevated bins, the bin sides are formed of inverted louvers over which excess water drains off.

Where pumping is necessary, with no available emergency method of handling, the conveying system must be in duplicate to provide a standby. When pollution of a river must be avoided, a settling area can be formed by an earth retaining wall. The water slowly drains down through the soil.

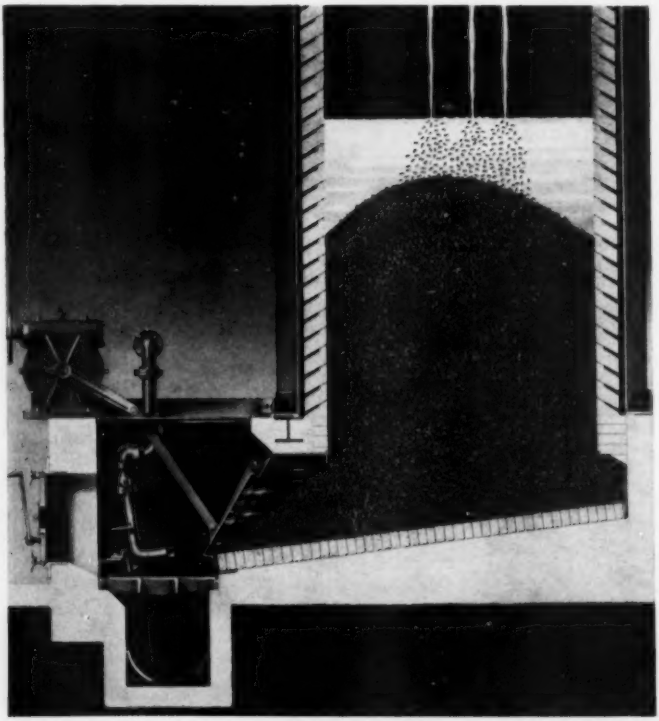

Fig. 2 — Ashes can be jetted from pits to sluice. Water at 100 psi and 175 gpm removes ashes at about one ton per hr. Courtesy, The Allen-Sherman-Hoff Co.

Jetting Ashes from Pits

Normally, the ashes are jetted from the pits, Fig. 2, to a sluice. If the route is on a slight downward incline, the sluice may be extended almost indefinitely, though we begin to run into quite a lot of water. The pit jet, with water at 100 psi pressure, discharging 175 gpm will flush out the ashes at a rate of about 1 ton per min. The sluicing nozzle should discharge 225 gpm to move the mixture at that rate, and each booster nozzle contributes the same amount, so for disposal to a point 400 ft from the station, the total water requirement would be 1750 gpm.

In small steam plants, where ashes are to be handled from a basement and spread over a near-by waste area, conditions may favor either the steam jet or the hydraulic method. If the plant operates on a schedule where the load drops at the end of the day, and the ashes may be handled then, the steam pressure otherwise wasted can be used advantageously to jet the accumulation.

Action at Incline

A jet nozzle located at the foot of a 35-deg. incline, pulls the ashes to that point and pushes them along to the far end. The equivalent of 70 to 100 hp will handle the ashes at 300 to 350 lb per min, which is about as fast as a man can hoe them into an intake.

A 10-in. pipe with a sluicing nozzle at the end and a booster nozzle at the incline, will handle the ashes with the requirement of 7 to 10 lb of water at 100 psi pressure, per pound of ashes. It is necessary to provide an air intake at the booster nozzle to assure a strong inrush of air due to the ejector action of the jet. This aerates the water and increases the velocity sufficiently to carry the mixture of water and ashes up the incline and onward. The limit of the lift may be 12 or 15 ft.

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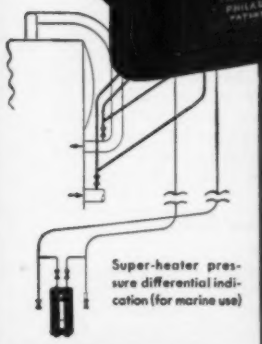
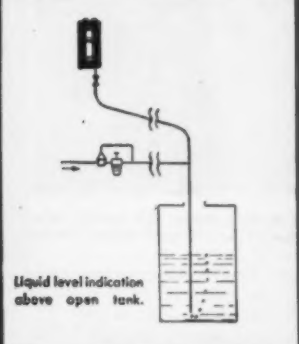
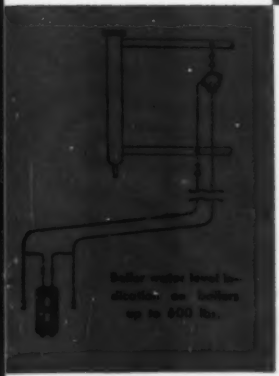
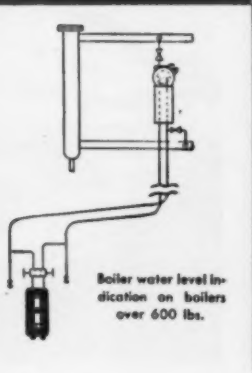


Super-heater pressure differential indication (for marine use)

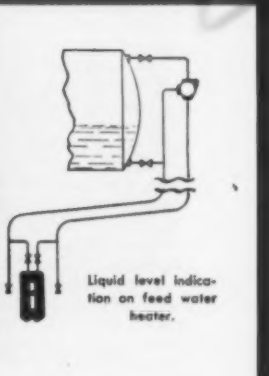


Liquid level indication above open tank.





Boiler water level indication on boilers over 600 lbs.



Liquid level indication on feed water heater.

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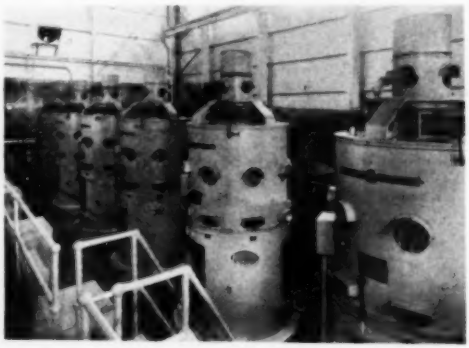
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

New York City Installs Hudson River Pumping Station with World's Largest Turbine Pumps

In an effort to adequately supply all municipal water uses for the nation's largest city and prevent a return of the waterless days of 1949, New York City has recently added a new pumping station 60 miles north of the city at Chelsea, N. Y.

The station will tap the waters of the Hudson river for 100 mgd and mix this with seven times that volume of upland watershed water, and, with additional chlorination,



Six Peerless close-coupled turbine pumps, the world's largest, in New York City's new Hudson River Pumping Station

provide an emergency supply. Contract for a plant to supply 100 mgd was awarded in the spring of 1950 to Tuller Construction Co. and A. S. Dillenbeck for $2,684,000.

To obtain pumps which could provide 100 mgd against a 575 foot lift, Peerless Pumps, a division of Food Machinery and Chemical Corporation, was given wide latitude to design the equipment.

The rated head was 575 ft but operation was called for at any head between 525 and 625 ft. Each pump required a capacity equal to 100 mgd divided by one less than the number of pumps installed, or a rated capacity of 14,000 gpm each. Peerless Pumps designed, and had accepted by the board, six of its vertical close-coupled turbine type pumps, the largest of the type ever to be manufactured. Of these six units, five would carry the full load, as each one has a capacity of 20 mgd at a head of 600 ft, allowing one for standby service. The pumps were ready for test in November, 1950.

These tremendous pumps have five 36 in. diameter bowls with discharge of 24 in. diameter. The synchronous type electric motors, directly connected to the pumps, each are rated at 2500 hp and operate at 900 rpm on three-phase, 60 cycle current at 4,000 volts. These motors were manufactured by the General Electric Company.

A system of automatic controls provides a fixed sequence of valve operations when starting the pumps, either normally or in an emergency during power failure. Controlled by electric interlocks a number of conditions must be fulfilled before motors are brought to full speed and synchronized and valves open. The same operation takes place in reverse when the stop button is pressed.

Largest Man-Made Rubber Plant Reactivated, Operating Slightly Above Rated Capacity

Reopening of the world's largest rubber plant—the giant government-owned facility at Institute, W. Va.—has been completed, according to W. S. Richardson, president of B. F. Goodrich Chemical Company. The plant had been in standby condition since 1947.

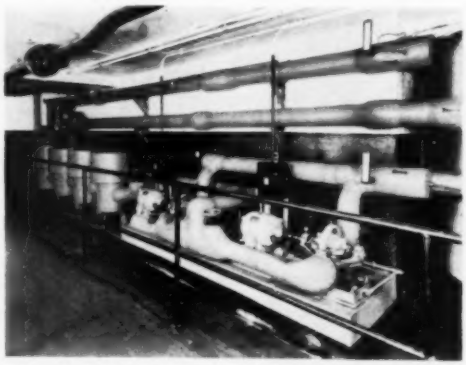
All production lines are now operating slightly above their rated capacity of 90,000 long tons of rubber annually. Rubber is made at Institute in three production lines, each with a rated capacity of 30,000 long tons.

According to Mr. Richardson, the job of reopening and reconditioning the plant included tearing down, cleaning, inspecting and replacing wherever necessary all valves, tanks, piping, condensers and motors, in addition to incorporating many process improvements made in the production of American rubber since the plant was closed five years ago.

Richardson said the chemical company also operates for the government the 60,000 ton unit at Port Neches, Texas, which is producing at 135 per cent of its rated capacity.

Vapor-Proofing On Cold Lines Keeps Insulation At Top Efficiency

Three parallel cold-water lines shown in the accompanying illustration have been insulated and vapor-proofed to insure long, maintenance-free service. This installation is in the basement of the William Penn Hotel, Pittsburgh, Pa.,



Pipe lines handling ice water at William Penn Hotel in Pittsburgh are insulated with molded mineral wool

where air temperature and humidity are comparatively high.

All three of the horizontal 4 in. pipe lines are covered with 1½ in. thick molded-type mineral wool sectional pipe insulation. Pipe fittings are covered with (A) 1 in. thick mineral wool felt insulation and (B) a 1 in. layer of insulating cement. The lower insulated pipe supplies circulating ice water from the refrigerating units and pumps throughout the hotel; the pipe thermometer on the right reads about 46 F (arrow indicates direction of flow). The long insulated pipe section in the middle supplies city water to the refrigerating system. The top length of piping is a section of the ice water return system and feeds circulated ice water to the refrigerating units for recooling. A typical reading on this thermometer is 49 F, indicating a rise of only 3 deg. throughout the system.

Natural Gas Coming to 125 New Cities Through 7,618 Miles of Added Pipelines

Current construction of 7,618 miles of new natural-gas pipeline involving record expenditures of $630,000,000 will bring new or additional benefits this year to millions of homes and thousands of industries in 125 cities of 50,000 or more population and in countless neighboring communities.

In addition to construction now under way, as authorized in 1950 by the Federal Power Commission, the fourth annual pipeline survey of the Gas Appliance Manufacturers Association also revealed that major applications involving an additional 15,866 miles of pipeline, to cost an estimated $943,640,000, awaited hearing and disposition by the Commission on January 1, 1951.

Assurances of adequate supplies of recoverable natural gas has encouraged American capital to embark on the industry's multi-billion-dollar program of construction. Despite a rapid rise in gas use by residential and industrial consumers during the past five years, new gas reserves each year have exceeded the annual rate of usage, it was revealed.

Current proven recoverable reserves, as estimated jointly by the American Gas Association and the American Petroleum Institute, the GAMA study reported, are at 185.6 trillion cubic feet — 5.2 trillion over reserves of the preceding year—despite record consumption of natural gas in 1950.

Westinghouse Equipment for New Jones & Laughlin Blooming Mill

Approximately $2,500,000 worth of electrical equipment will be supplied by Westinghouse Electric Corp. for the new 46-in high-lift blooming mill at the Jones & Laughlin south side works in Pittsburgh, Pa. New design features and a special control scheme will provide rapid reversals, making this mill one of the fastest of its size ever to be built.

The main reversing drive will total 10,000 hp, delivered by twin 5000 hp, d-c reversing motors coupled directly to the upper and lower rolls. The speed range of these motors will be from 40 to 100 rpm. A flywheel motor-generator set having four 2500 kw generators will supply d-c adjustable-voltage power to the main drive motors. An 8000 hp wound-rotor motor will drive the d-c generators, and will be controlled by a new type liquid slip regulator. This regulator will permit the flywheel to give up its energy when peak loads are applied to the twin main drive motors during reversals. Rototrol rotating regulators will provide load balance between the twin motors of the main drive, and between the four 2500 kw generators.

Mill auxiliaries will be driven by both constant-voltage and adjustable-voltage d-c motors and by a-c motors, all of which will total approximately 6000 hp. Rototrol regulators and special control schemes will be used where necessary

ACCRITEM

Provides Accurate Low Cost Heat Control for liquids or air

Compressed air or water operated

POWERS

ACCRITEM REGULATOR

Small Size
Easy to Adjust

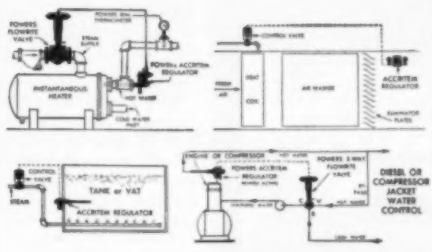
Ranges: 50 to 250° F. and 150 to 350° F.

Use ACCRITEM to control pneumatic or water operated diaphragm valves. Calibrated dial provides easy temperature adjustment. It is easy to install. Has adjustable sensitivity and over-heat protection.

Dependable—rugged construction of this heavy duty regulator insures many years of reliable service.

Size—regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long, diam. ⅜" with ½" I.P.S. connection.

Use POWERS ACCRITEM REGULATORS for



Also—Air conditioned bakery proof boxes and fermentation rooms, rotary type dryers and many other applications.

Powers quality line of FLOWRITE and METAFLOW diaphragm valves controlled by a Powers ACCRITEM Regulator provide an unbeatable combination for better control.

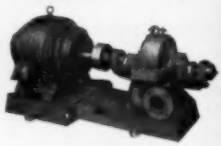
Write for Bulletin 216

THE POWERS REGULATOR COMPANY

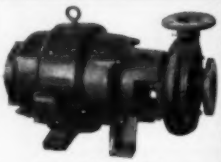
2777 Greenview Avenue, Chicago 14, Illinois (AMA)

Established 1891 • Offices Over 50 Cities • See Your Phone Book

WEINMAN pumps assure uninterrupted service



Two Stage Split Case Pump for high-head service.



General Service Unipump for use where space is limited.

Non-clogging type "U" for liquid carrying solids.

Because plants take their pumping systems for granted a pump break-down most often comes as an expensive surprise.

It's reassuring to have the stamp of approval placed on your plant's pumping system by a WEINMAN Centrifugal Specialist. This man is thoroughly familiar with your requirements. The company that he represents has been a leader in this field since before the turn of the last century. He has earned his title "CAREER MAN IN PUMPS."

It will pay you to invite this man through your plant. His recommendations will help you NOW . . . will help prevent trouble LATER. Just write, wire or phone TODAY.

Representatives in Principal Cities

The WEINMAN Pump Mfg. Co

to provide the fast operation necessary to match the speed of the main drive.

A Westinghouse semi-automatic Precipitron electronic air cleaner and Westinghouse Sturtevant fans will keep the motor room pressurized with clean air. This equipment also will supply clean ventilating air to motors located outside the main motor room.

Power for the mill will be supplied at 13,800 volts, 3 phase, 60 cycles, and distributed through Westinghouse switchgear, transformers and power centers.

New Floor Engineering Service Offers Savings to Industrial Firms

Because the installation of industrial floors for maximum life and minimum cost is a highly specialized task that requires expert planning and skilled technical execution, the Flash-Stone Co. has established a unique, integrated service to American industry. Through floor engineering, the varied factors affecting floor life are evaluated and the proper flooring material is specified; also, with the aid of experienced crews, new or resurfaced floors are installed in minimum time. The Flash-Stone service accepts complete responsibility for engineering, materials and installation.

Savings from engineered floors are realized through lowered costs, assured maximum life, speeding the movement of material handling, reducing downtime required for installation, eliminating the dust and dirt frequently connected with the resurfacing, and construction of floors having adequate transverse and compression strength so that floor maintenance is minimized.

Baldwin-Hill Insulation Products Qualify For Bureau of Standards Certification

Baldwin-Hill insulation products have qualified for certification which will protect the company and the user against inferior products, according to Miles M. Wilson, general manager of the company's industrial sales.

The certification label will be displayed on every bag of

(Continued on page 150)

CONVEYER SPEEDS OPERATIONS AT GRAVEL PIT

Traveling at a speed of 500 ft per min, this conveyer belt delivers 600 to 800 tons an hour from the gravel pit to a stock pile 2000 ft away. Belt is driven by a General Electric 200-hp motor through a speed reducer manufactured by Western Gear Works, Seattle, Wash. Equipment is in use at the Azusa, Calif., plant of Consolidated Rock Products Co.

Now! Dearborn offers a sure, simple way to

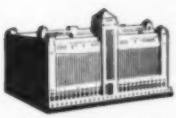
stop rust before it starts!

Rust works every minute, destroying your plant . . . your valuable equipment. But, rust can be stopped—before it starts or after it has started—with Dearborn NO-OX-ID Rust Preventives.

As a service to industry, Dearborn has prepared a helpful Check-Chart and NO-OX-ID Plant Maintenance Survey form. With this material, it's an easy matter to flag the many places where rust threatens your plant . . . and then set up a simplified and continuous maintenance program to rid your plant of rust.

WRITE FOR YOUR COPY. Mail the coupon to obtain your copy of the NO-OX-ID Check-Chart and Plant Maintenance Survey. Or, if you prefer, a Dearborn representative is ready to assist you in your fight against rust.

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois



NEW GENERAL OFFICES

The new and enlarged general offices of Dearborn Chemical Company are now located in The Merchandise Mart.

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza, Dept. INP
Chicago 54, Illinois

Send my copy of the Dearborn Check-Chart and Plant Maintenance Survey ☐

Have a Dearborn representative call ☐
(Please Print)

Name.....

Company.....

Address.....

City.....*Zone*....*State*.....

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Reg. U.S. Pat. Off.
THE ORIGINAL RUST PREVENTIVE
NO-OX-ID
IRON + OX = RUST

NEWS . . . of men and companies

HONORS

American Iron and Steel Institute—E. L. Ryerson, chairman, Inland Steel Co., was presented the Gary Memorial Medal for outstanding achievement in the iron and steel industry.

General Electric Co.—The Georgia Power Co. was presented the Charles A. Coffin award for 1950 for outstanding accomplishment by an electric utility.

United States Steel Corp. — The Bessemer Medal for 1951 was awarded to Benjamin F. Fairless, president, by the British Iron and Steel Institute, in recognition of distinguished services to the iron and steel industry.

SOCIETIES

The American Institute of Electrical Engineers—F. O. McMillan, head of the electrical engineering dept., Oregon State College, was elected 1951-52 president. In addition to academic work, he has been active as a consulting engineer for public utilities.

American Iron and Steel Institute—The following officers were reelected: W. S. Tower, president; B. F. Fairless, president, United States Steel Corp. and Frank Purnell, chairman of The Youngstown Sheet and Tube Co., vice presidents and George S. Rose, secretary. M. D. Howell, v-p and treasurer of United States Steel Corp. was elected treasurer.

Illuminating Engineering Society—S. G. Hibben, Westinghouse Electric Corp., was elected president. Other officers are: A. H. Manwaring, Philadelphia Electrical & Mfg., v-p; R. F. Hartenstein, Ohio Edison Co., treasurer; C. C. Keller, Holophane Co., general secretary; and G. W. Beals, The Miller Co., and J. S. Schuchert, Duquense Light Co., directors of the society.

Magnesia Insulation Manufacturers Assoc.—H. A. Kieselbach, general manager of the insulation dept. for Johns-Manville Sales Corp. until his retirement, has been retained as technical consultant to the association.

National Association of Fan Manufacturers, Inc.—The following directors were elected: H. E. Barth, American Blower Corp.; J. M. Frank, Ilg Electric Ventilating Co.; J. C. Thompson, Westinghouse Electric Corp., Sturtevant Div.; E. E. Trickler, The New York Blower Co.; and L. O. Monroe. The board elected J. M. Frank president, E. E. Trickler v-p, and L. O. Monroe secretary-treasurer.

ANNIVERSARIES

J. H. Bennis

New York & New Jersey Lubricant Co.—J. H. Bennis, president, announced the 55th anniversary of the company.

Mr. Bennis was most appropriately congratulated on the anniversary, having been continuously associated with it almost since it was started when the petroleum industry was just beginning to evolve into its modern phases.

Benjamin Electric Mfg. Co.—The 50th anniversary was celebrated June 4 with an open house, plant tour and an address by Congresswoman Margaret Stitt Churchill.

SALES OFFICES

Acheson Colloids Corp. — The New England office was moved to 89 Broad Street, Boston.

Riley Stoker Corp.—Direct factory branch office is established at 504 Pan American Bldg., Camp and Poydras Streets, New Orleans.

Sarco Company, Inc.—Chicago midwest headquarters is moved to new quarters at 322 W. Randolph St., Chicago.

Westinghouse Electric Corp.—With a new 46,000 sq ft office, the Northwestern District headquarters are now located in the Merchandise Mart.

Thomas C. Wilson, Inc.—New office at 3147 North Broad St., Philadelphia 32, is opened.

NEW REPRESENTATIVES

Cleaver-Brooks Co.—Keatts Thermal Equipment Co., Columbus, O. is a manufacturers' representative for boiler equipment.

Standard Transformer Co.—Carl A. Froebel is representative for eastern Missouri and southern Illinois.

Temperature Equipment Corp.—A new department for the distribution of industrial heating equipment, including Cyclotherm Steam Generators, and direct fired unit heaters made by American Foundry & Furnace Co. has been formed.

EXPANSIONS

Allis-Chalmers Mfg. Co.—The Austin Co. is general contractor for the $5,000,000 engineering and construction

(Continued on page 118)

SMALL STEAM PLANTS CONSULTING SERVICE

Smoke control engineers attending the convention of the Air Pollution and Smoke Prevention Assoc. of America at Roanoke, Va., heard Earl Payne, consulting engineer for the Pittsburgh Consolidation Coal Co. announce that the coal industry proposes to organize a nationwide fuel and equipment consulting service for the small steam plants.

The announcement is the result of a survey of equipment in 25 cities covering more than 4000 boiler units and which showed an appalling state of affairs. Almost 25 per cent of the equipment is mechanically defective, 8 per cent obsolete, 10 per cent overloaded, 30 per cent improperly operated and 21 per cent could use stokers in its operation.

• The National Production Authority, U. S. Department of Commerce, announced the membership list of the Boilers and Related Equipment Industry Advisory Committee as follows:

W. T. McCullough, Jr., vice president
Babcock & Wilcox Co.

Paul M. Fleming, vice president
The Bigelow Co.

R. J. Bros., president
Wm. Bros. Boiler & Mfg. Co.

W. P. E. Ainsworth, vice president
Combustion Engineering-Superheater, Inc.

W. H. Riecks, president
Detroit Stoker Co.

F. G. Brinig, president
Erie City Iron Works

P. W. Foster, Jr. vice president
Foster Wheeler Corp.

F. W. Hainer, president
Cleaver-Brooks Co.

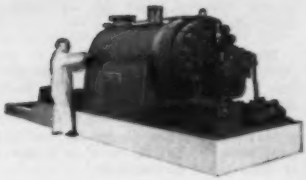
C. W. Miller, sales manager
E. Keeler Co.

L. C. Train, president
Lucey Boiler Manufacturing

A. B. Shafer, vice president
Puget Sound Machinery Depot

F. H. Daniels, chairman
Riley Stoker Corp.

R. J. Stormont, vice president
The Wickes Boiler Co.

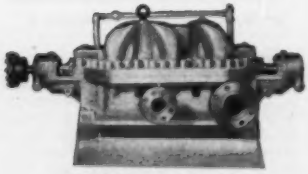


BJ DOUBLE CASE BOILER FEED PUMPS

Designed for high capacity, high pressure, high temperature applications. Capacities to one million lbs. per hour and pressures to 2800 psi. Radial forces are balanced through double volute design and axial thrust is balanced by opposed grouping of impellers.

BJ HYDROPRESS PUMPS

Designed for low capacity, high pressure, high temperature applications. Capacities to 300 gpm and heads to 7000 ft. Basically the same as the Double Case except for vertical construction. The Hydropress saves space, simplifies piping, needs only a simple foundation, and is extremely convenient for inspection and servicing.



BJ MULTIPLEX PUMPS

Type SD Multiplex Pumps are designed for high capacity, medium pressure, medium temperature applications. Capacities to 2000 gpm and heads to 3000 ft. Feature a horizontal split case with crossover passages between stages cast integrally with the case. Staggered volute construction.

A 36-MILLION-LB. SQUEEZE

Mesta Machine Co. press operated by Wyman-Gordon Products Corp.

FOR BIG PERFORMANCE

BJ

Builds the Best Pump for the Job!

BJ Pumps provide the pressure for the World's largest forging press

When this powerful Mesta forging press applies its 18,000-ton might, it presses high-strength billets into intricate parts as neatly as a baker shapes pastry or cookies.

This massive four column die-forging press—the World's largest—was engineered to produce extra large magnesium and aluminum forgings vital to modern aircraft development. Towering 32 ft. high and resting solidly 15½ ft. below the floor, this mammoth machine responds quickly and smoothly despite its 5-million-pound bulk.

The secret of its awesome strength and operating ease is hydraulics—with pressure provided by Byron Jackson pumps.

Three BJ double case 8-stage hydraulic press pumps take water at 100 lbs. per sq. in. and build it to a mighty 5300 lbs. psi pressure force. This high-pressure water is stored in thick-walled accumulators and used to drive the press's 48-in. dia. pistons.

NOTE TO ENGINEERS: Your pumping problem—whether high or low pressure, large or small, standard or special—can benefit from the same sound pump engineering which worked on this job. Byron Jackson Co. designs and builds centrifugal pumps for industrial applications of all descriptions. Bring your pumping problem to BJ—there's no obligation.

BJ CAN ENGINEER AND BUILD THE BEST PUMP FOR YOUR JOB—SEND THIS COUPON FOR MORE INFORMATION...

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OFFICES IN PRINCIPAL CITIES

BJ PUMP ENGINEERING DEPT. 62

Our job is pumping_____

Send me additional data on BJ pumps for this work.

NAME_____

ADDRESS_____

CITY_____ STATE_____

(Continued from page 116)

EXPANSIONS

program planned in Terre Haute, Ind. Included is a heating plant, sewage disposal and water systems.

Baldwin-Hill Co.—The Tex-Rock Insulation Mfg. Co. has been purchased. New machinery will be installed and the entire operation modernized.

Bellevue Industrial Furnace Co.—Removal of the plant and general offices to 2620 Crane Ave., Detroit is announced. Construction is underway to more than double the floor space.

Cummins Engine Co., Inc.—Expansion of engine production capacity with new facilities costing $6,000,000 is announced.

Dow Chemical Co.—A new plant to make vinyltoluene, a substitute for styrene is authorized to be started this fall. Stone-Webster Engineering Co. will engineer it.

Du-Co Ceramics Co.—Near completion of its expansion program will provide a 600 per cent increase in space.

E. I. du Pont de Nemours and Co.—New office building near Newark, Del. will be started at once. It will have 200,000 sq ft of usable office space.

H. K. Ferguson Co.—Westinghouse Electric Corp. has awarded contracts for design and construction of a new electronic tube plant of 350,000 sq ft in the town of Horseheads, N. Y., in addition to the plant at Bath, N. Y.

General Controls Co.—Construction on a 24,000 sq ft addition to the engineering building at the Glendale plant is started.

General Electric Co.—Wigton-Abbott Corp. will proceed with engineering and construction necessary for additional manufacturing area at the Johnson City plant. Option to lease manufacturing space in Ludlow, Vermont was taken for expanded jet-engine production.

General Motors Corp.—Buick div. will build a multimillion dollar jet engine plant near Willow Springs, Ill. The main structure and auxiliary units will occupy 1,650,000 sq ft.

Hewitt-Robbins Inc.—Foam rubber capacity will be increased by 50 per cent by acquisition of the rubber plant of Belfer Corp. on Staten Island.

Illinois Institute of Technology — Construction of a new research laboratory is started. Cost will be $600,000.

Industrial Filter & Pump Mfg. Co.—A building on Ogden Ave., near Austin Blvd., Chicago, has been purchased.

R. G. LeTourneau, Inc.—Construction of its own steel mill at its plant at Longview, Tex. is started. It will handle 1,000 ton per day of finished steel plate.

Marcus Transformer Co. — A one story brick building to extend productive space by 50 per cent is being added.

Stewart Warner Corp.—A building containing 33,000 sq ft was acquired at 2625 West Grand Ave.

Westinghouse Electric Corp. — A half-mile long plant for jet engine components, and later for electric home appliances, will be built near Columbus, O. It will have 1,900,000 sq ft of floor space.

Wigton-Abbott Corp.—Contract for construction of a $3,000,000 helicopter engineering and manufacturing plant for the Bell Aircraft Corp. has been jointly received with the Tellepsen Construction Co., Inc.

Wyman-Gordon Co.—Ingalls Shepard Div. in Harvey, is erecting a large boiler plant and making other alterations for increased output of aircraft forgings.

APPOINTMENTS

Edward Valves, Inc.—C. W. Nedderman was made responsible for budget, financial. and accounting.

C. W. Nedderman **A. Howard**

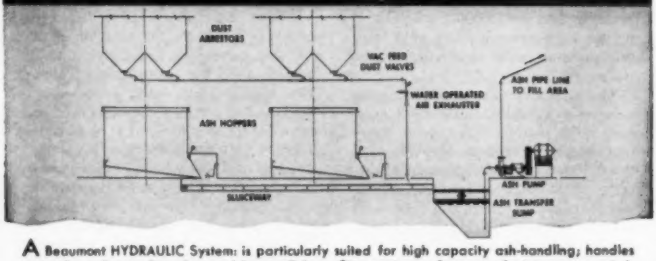
General Electric Co.—R .S. Walsh was made manager of Induction Motor Sales Div. Alan Howard is operation manager for the Gas Turbine Div. and J. P. Keller is his assistant. J. T. Holleran was appointed manager of the Fort Edward and Hudson Falls operations of the Transformer and Allied Products Div. E. W. Lankenau, retired as manager of the Decatur plant, is succeeded by J. F. Welch. G. H. Campbell replaces A. W. Lunn, retired, as manager, Newark office.

Aluminum Company of America—C. S. Thayer has been named manager of the company's Northwest operations. This includes managership of the new smelting plant to be built at Wenatchee, Wash. W. N. Farquhar is named works manager.

Allis-Chalmers Mfg. Co. — W. A. Yost is named head of the new mechanical power department. Reporting to him are O. A. Haas, manager of blower and condenser section; T. J. Hodan, manager of water conditioning section; C. C. Jordan, manager of the steam turbine section, and W. J. Rheingans, manager of the hydraulics section. T. J. Hanley was made supervisor of electrical and hydraulic turbine service and erection.

Need Large Capacity Ash-Handling?

CHECK WITH BEAUMONT ON A HYDRAULIC ASH-HANDLING SYSTEM



A Beaumont HYDRAULIC System is particularly suited for high capacity ash-handling; handles wet ash or dry, molten slag and large clinkers; fits any type of power plant arrangement; is completely enclosed, preventing dust or gas from escaping to the boiler room; and can be operated by one man on a part time basis.

Beaumont's Ash-Handling Division is competently staffed to give you expert recommendations on all types of ash-handling systems . . . and to provide and install the proper equipment to suit your particular requirements. Write today for the Beaumont brochure: "Answers to Your Ash-Handling Questions".

Beaumont BIRCH COMPANY

1509 RACE STREET, PHILADELPHIA 2, PA.

DESIGNERS—MANUFACTURERS—ERECTORS BULK MATERIAL HANDLING SYSTEMS

American Air Filter Co. Inc.—G. C. Rodgers and I. W. Clark were appointed managers of the military sales dept.

American Chain & Cable Co., Inc.—C. E. Witt is sales manager for the Pittsburgh district of Wright Hoist and Ford Chain Block Divisions.

Bar-Way Co.—E. S. Flint, industrial engineer and designer is made general manager.

A. S. Campbell Co.—W. S. Axford is elected director and executive v-p of the company and the subsidiaries, Hunt-Spiller Mfg. Corp. and Rollins Engine & Machine Co.

Chiksan Co.—N. A. Guill is made division manager of the Chicago branch office, with W. L. Clark his assistant.

Continental Motors Corp.—E. J. Brichta is sales manager of the industrial air-cooled engine div.

Dampney Co. of America—L. W. MacLean fills the newly created position v-p of manufacturing and engineering.

Detrex Corp.—W. F. Lucas is the western region manager with headquarters in the Chicago office.

Dravo Corp.—E. S. Mason, Jr. is sales engineer for the Machinery Div. in the Cincinnati territory. He will handle Dravo heaters and products of DeLaval Steam Turbine Co., C. H. Wheeler Div. of Hamilton Thomas Co., Fuller Co. and Walker Process Equipment, Inc.

E. I. du Pont de Nemours and Co., Inc.—Dr. Cole Coolidge was appointed director of the Chemical Dept. for research activities. W. A. Bours III was made manager of the plant's development section, Organic Chemicals Dept.

General Motors Corp.—Promotions in the New Departure Div. are S. H. Stoner, general works manager; F. J. Garbarino, chief engineer; J. J. Curry, asst. to general works manager; R. T. Collins, Meriden, Conn., plant manager; W. J. Ryan, Bristol, Conn., plant manager and H. J. Gurske, Sandusky, O., plant manager.

B. F. Goodrich Co.—W. L. Carpenter was made manager of the tire plant in Oaks, Pa. He succeeds J. F. Sweatt, who becomes manager of the tire plant in Los Angeles. C. H. Schroeder is technical manager of textiles in the industrial products div.

Goodyear Tire & Rubber Co.—C. H. Maxwell is named plant manager of the general products div., Plant C.

Hercules Powder Co.—L. H. Burt is supervisor, product development, for the Cellulose Products Dept.

Hunt-Spiller Mfg. Corp.—F. I. Fickett is engineering representative in Indiana, Ohio and Michigan.

Illinois Institute of Technology—W. P. Green, ass't. chairman of applied mechanics research, is now chairman of a new heat-power research dep't.

Manning, Maxwell & Moore, Inc.—E. H. Price was made Pacific Coast district manager succeeding N. P. Selover, now director of export planning.

Michigan Oven Co.—A. C. Towne, Jr. was elected president.

Pacific Mills—H. W. Leitch, superintendent of research, is a member of the Advisory Committee on Water Pollution Control in Massachusetts.

Reliance Electric & Engineering Co.—L. F. Giegel is branch manager of the Gary office and D. J. Donnelly sales engineer is added at Philadelphia.

Rockwell Mfg. Co.—N. W. Rowand is general manager of the Pittsburgh plant of the Meter and Valve Div.

N. W. Rowand **A. P. Jeffery**

The Swartwout Co.—A. P. Jeffery is power plant equipment sales engineer for the Albany and Schenectady territory, effective immediately.

Ross Operating Valve Co.—R. J. Cameron has been elected president.

Sterling Electric Motors, Inc.—Additions to the sales and engineering staff are J. F. Ingle, district manager, San Francisco; R. P. Killion, district manager, Houston; H. L. Fritz, Baltimore; E. W. Hodge, Jr., Birmingham; J. P. Foley, C. E. O'Leary and R. S. Portner, New York City; and Melvin Maxham and John Malloy, Los Angeles.

Texas Gas Transmission Corp.—W. T. Stevenson has been elected president.

Timken Roller Bearing Co.—H. J. Urbach was made executive engineer; R. A. Schimpf, chief works engineer; C. M. Maratta, chief consulting engineer and L. A. Holder, chief mechanical engineer.

United States Air Conditioning Corp.—D. E. Feinberg is made v-p.

Westinghouse Electric Corp.—T. I. Phillips, v-p, has been assigned to the staff of John K. Hodnette, v-p, for the industrial products expansion program. Dr. A. W. Wishart, v-p of McKee Glass Co. is now manager of the new Glass Manufacturing Div. R. E. Ferry is manager of apparatus sales offices in Wheeling and Fairmont, W. Va. and W. H. Bingham is eastern

(Continued on page 120)

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RANAREX
PRODUCT OF PERMUTIT

(Continued from page 119)

APPOINTMENTS

district manager of Westinghouse Electric Supply Co. M. F. Slusser is administrative assistant, industrial products sales and C. M. Harnish, manager of order service for the Motor and Control Div., Buffalo.

Worthington Pump and Machinery Corp.—L. M. Evans is in charge of the new Rochester branch office at 1246 Sibley Tower Building.

York Corp.—J. R. Hertzler, v-p and general sales manager, J. K. Louden, v-p and E. P. Vanderwicken, v-p and treasurer were elected to the board of directors of the company.

OBITUARIES

Allis-Chalmers Mfg. Co.—T. M. Heermans, assistant manager of Sales of the centrifugal pump department died recently.

Hagan Corp.—John M. Hopwood, chairman of the board died June 8. Other companies of which he was head and co-founder were Hall Laboratories, Inc., Calgon, Inc., Buromin Co.

National Electric Products Corp.—J. H. Gross, manager of Neproduct sales died suddenly on June 7 at 67 yr.

REVIEWS of RECENT BOOKS . . .

Recent books, published for men responsible for The Engineered Plant Services, are reviewed here. Write to the publisher for those in which you are interested

Smoke Prevention Papers

"Papers Presented at the 43rd Annual Meeting of the Air Pollution and Smoke Prevention Association of America, Inc." John Paul Taylor, Publisher, 520 Pleasant St., St. Joseph, Michigan. 122 pages, 25 illustrated articles, paper bound, Price, $5.00.

Papers presented at the 1950 meeting of the Air Pollution and Smoke Prevention Association of America, Inc. have been assembled and are now available to industry. The contents range from a description of steel industry activities regarding air pollution to a discussion of smoke ordinances. Papers presented were authored by prominent consulting engineers, smoke inspectors, industrial engineers, equipment manufacturers, railroad engineers and numerous others.

Partial list of papers and authors include: "Railroad Smoke Control, Past, Present, Future" by Chas. W. Gruber, Chief Smoke Inspector, "Railroad Activity in Reducing Air Pollution" by Earl C. Payne, "How Practical Does the Operating Engineer Find Smoke Ordinances?", "Instrumentation and Procedures for Quantitative Measurements," "The Importance of Incineration as it Applies to Air Pollution Control" by E. E. Smauder, "Air Pollution Other Than Smoke" by Sumner B. Ely, "Public Relations in Air Pollution Control" by K. C. Richmond, "Meteorological Techniques in Air Pollution Surveys," "Testing for Fly-Ash Emission by The Small Steam Plant" by Philip F. Best and "Stack Disposal of Chemical Waste" by C. A. Gosline.

Plant Layout

"Plant Layout—Planning and Practice," by Randolph W. Mallick and Armand T. Gaudreau. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. Contains 391 pages, well illustrated with drawings and photographs. Price $7.50.

Accumulation of practical field experiences that are compiled into a well composed and edited book that is easy to read and simple to understand. It will be an added source of concrete information to the plant engineer and executive. The material has been divided into four separate subjects: the approach to plant layout, planning the plant processing department, designing plant service facilities, and justifying the layout project.

Electronic Computer

"A Functional Description of the E D V A C," the electronic digital computer developed by the University of Pennsylvania for the Army Ordnance Department. 400 pages of text diagrams and tables, in two volumes plus an errata section. Price $9.00, orders should be addressed to the Moore School of Electronic Engineering, the University of Pennsylvania, Philadelphia 4, Pa.

This report, containing a logical description of the various components, is presented in such a way that the reader is introduced first to the general units, and then to the more specialized ones. Main parts of the report cover the general principles of the EDVAC; the dispatcher, the EDVAC control, the computer, the memory, the reader-recorder, the timer, power supply, and the switchgear. Appendices include a physical description of the EDVAC, list of remote connections, definitions and abbreviations, general principles of crystal-diode gating circuits, and the EDVAC drawings.

Thermodynamics

"Thermodynamics", Second Edition, by George A. Hawkins. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Includes 563 pages, illustrations, tables and charts. Price $6.50.

This book was written for the purpose of providing a well balanced treatment of engineering thermodynamics. To accomplish this objective the fol-

lowing steps were taken. Theoretical presentations are supplemented by the addition of simple practical examples, which show the usefulness of the subject in professional engineering work. Importance of the correct application of units is emphasized by discussion and examples. An effort is made to show that the subject of thermodynamics is not limited to engineering but is applicable to other branches of science as well.

Available and unavailable energy and entropy have been treated at considerable length to give the reader a clear concept of entropy. Considerable space has been given to the topic of gas mixtures and gas-and-vapor mixtures. A chapter deals with the fundamentals of heat transfer.

RECENT INDUSTRIAL FILMS

High-Power Electrical Testing

That present-day, high standards of electrical equipment didn't just happen is the theme of a new color-sound movie entitled "Electrical Proving Ground," recently released by Westinghouse Electric Corp. A 26-minute presentation tells the story of testing switchgear and other electrical equipment at full power and voltage in the Westinghouse High Power Laboratory at East Pittsburgh. Spectacular shots indicate the tremendous concentration of over 3,000,000 kva available for testing larger equipment.

Power company groups, technical societies, civic organizations and educational institutions may obtain the film for the cost of mailing. Application should be made to nearest Westinghouse District Sales office.

Uses of Stud Welding

"Split-Second Welding," an 18-minute color-sound movie, portrays uses of stud welding in construction, railroad, process, and metal working industries. Produced for the Nelson Stud Welding Division of Morton Gregory Corp., the film may be obtained for showing by writing the company's headquarters at Lorain, Ohio.

Power in the Postwar World

"New Power for America" is the title of a new 16-mm Kodachrome sound-motion picture produced by Combustion Engineering-Superheater, Inc. Depicting ever-increasing use of electrical power in America's homes, farms and industries, film traces progress made in science of power generation in last three decades and emphasizes importance of this progress both in economy of power production and conservation of fuel. Film presents pictorial progress report of erection of principal equipment components as well as structure for the Sewaren station of the Public Service Electric and Gas Co. of New Jersey. Operation of the boiler, the flow of fuel, gas, water and steam is revealed by animation.

Engineering schools, societies, and other organizations interested in scheduling this picture should address Combustion Engineering-Superheater, Inc., 200 Madison Ave., New York 16, N. Y. Running time is approximately 35 minutes.

MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

AUGUST

American Institute of Electrical Engineers Pacific general meeting will be held at Multnomah Hotel, Portland, Oreg., Aug. 20—23. Technical sessions and inspection trips including the Bonneville Dam Power House, are scheduled. Write to H. H. Henline, AIEE, 33 West 39th St., New York.

Illuminating Engineering Society—National Technical Conference will be held Aug. 27-30 at the Hotel Shoreham, Washington, D. C. Fifty papers will be presented in nine technical sessions.

SEPTEMBER

National Instrument Conference and Exhibit will be held in the Sam Houston Coliseum in Houston, Texas, September 10-14. Write the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, Pa., for information.

American Society of Mechanical Engineers holds its fall meeting at Hotel Radisson, Minneapolis, Sept. 25—28.

OCTOBER

National Association of Corrosion Engineers holds the annual meeting of the South Central Region at Corpus Christi, Texas, October 18-20. G. A. Mills, Central Power and Light Co., is general chairman of the meeting.

American Institute of Electrical Engineers has scheduled the fall general meeting for Cleveland, Oct. 22—26.

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- Cleans Commutators
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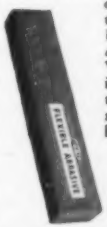
The perfect tool for use following grinding or using a regular Resurfacer on the commutator. Made of a fine grain abrasive material held together by a flexible bond. It's gentle, fast action quickly removes surface imperfections with minimum cutting . . . Used as a commutator cleaner it quickly removes high resistance film, dirt and grease. Cleans like an eraser and generates very little dust—wears down slowly without "gumming" or dusting. Does not affect the face of the brush or cause filling of commutator slots. Non-conductive and non-loading — can be safely used with motors or generators operating. *Will not scratch or score commutators or rings* . . . Very easy to use. Just hold it against the face of the turning commutator or slip ring. FIVE SIZES — Order by Catalog number.



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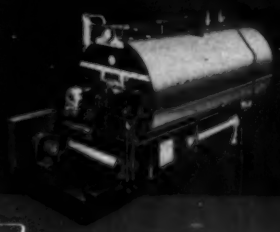
QUIETER, CLEANER, SAFER, with
SUPERIOR'S Built-in, INDUCED Draft.

Superior's Induced Draft prevents the escape of combustion gases into the boiler room . . . even through an open port. For our photo shows one of our engineers observing the fire through the wide open pressure-relief port.

It also explains one other distinct advantage of induced draft . . . the fact that the fire is pulled through each successive pass without impingement and wear on refractory as is the case under forced draft. For that relief port is at the end of the first pass where the combustion gases are turning the corner into the second pass. If they weren't being led, some of them would find their way out through the open port.

Greater quiet; longer trouble-free operation; cleaner, more healthful atmospheres are other primary results. We can't tell you the whole story here, but you'll find it all in our new catalog. Write today to reserve your copy of the newest edition. Ask for Catalog 302



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TIMES TOWER, TIMES SQUARE, NEW YORK 18, N. Y.

SUPERIOR
STEAM GENERATORS

readers' guide to advertised products

Here you'll find, briefly reviewed, all the booklets and leaflets offered in the advertising columns of this issue of INDUSTRY AND POWER. For easy reference, this listing is divided into various classifications of products. To get your free copies of literature described here and in the corresponding advertisements, list the key numbers of the paragraphs on the cards below and mail.

AIR & DUST FILTERS & COLLECTORS

500—See page 58. Electrical Precipitation: Write for your free Bulletin 500 which presents full information on the Cottrell Precipitator. It effectively cleans stack gases by removing over 95% of all fly ash particles. Research Corporation.

ANTI-CORROSIVE & PROTECTIVE COATINGS

502—See page 115. Rust Preventives: Dearborn offers a sure, simple way to stop rust before it starts. Mail coupon to obtain your copy of NO-OX-ID Check-Chart and Plant Maintenance Survey. Or ask for a Dearborn representative to call. Dearborn Chemical Company.

503—See page 59. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete literature. Rust-Oleum Corporation.

BOILERS & BOILER ACCESSORIES

504—See page 146. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125. 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

505—See Page 42. 2-Drum Water Wall Boilers: Shipped built-up in sizes to 300 hp, these boilers are clearly described in an attractive bulletin. Side wall water cooling is an integral part of these low headroom 2-drum boilers. Write for VL Bulletin with complete data. Erie City Iron Works.

506—See page 52. Steam Generating Units: Complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels. Bulletins with general information and showing typical installations are available upon request. Henry Vogt Machine Co.

507—See page 108. Vane Control: A new Bulletin, DB 92-810, describes the mechanical improvements developed for Sturtevant Vane Control and its use in mechanical draft, industrial and ventilating applications. Write today for your free copy. Westinghouse Electric Corp., Sturtevant Division.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

501—See pages 53, 54, 55, 56. Air Cleaning Equipment: Write for complete information on The Upjohn Company's mammoth new plant equipped for clean air by AAF. Engineering Bulletins available covering all phases of air cleaning and the complete line of AAF products. Write today. American Air Filter Company, Inc.

508—See page 47. Trane Equipment: Whatever your factory heating, ventilating, cooling or air conditioning problem is look first in the answer in the Trane line. An inquiry will bring you complete data on equipment engineered for your particular job without obligation. The Trane Company.

509—See page 125. Heavy-Duty Fan Equipment: Write for complete information on Clarage heavy-duty fans in-

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To: INDUSTRY AND POWER, St. Joseph, Michigan **July, 1951**

Please have forwarded to me, at no obligation, the literature I've indicated by the following key numbers:

Inquiries for items listed in this issue not serviced beyond Oct. 1, 1951

Advertised Products Numbers begins Page 123	*New Equipment Numbers begins Page 10*	*New Bulletin Numbers begins Page 24*

Your Name_____ **Title**_____

Your Company_____

Co. Address (St. & No.)_____

City_____ **State**_____

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readers' guide to advertised products

stalled in The Upjohn Company. Upjohn has had more than a quarter-century of experience with Clarage equipment. 120 complete systems handling 2,800,000 cfm are installed. Clarage Fan Company.

BUILDING MATERIALS & MAINTENANCE

510—See page 149. Free Repair Handbook: 40 pages describing Smooth-On repairs that can save you time and money. 170 illustrations. Write for your free copy now. Smooth-On Mfg. Co.

511—See page 149. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and "Hand Book of Building Maintenance". Flexrock Co.

512—See page 121. Flexible Abrasive: Cleans like an eraser — gentle, fast action quickly removes surface imperfections with minimum cutting. Cleans commutators, gives burnished finish to commutators after grinding. Mail coupon for free 40-page handbook "Commutator and Slip Ring Maintenance". Ideal Industries, Inc.

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers of the paragraphs describing the items you want in the spaces provided on cards below.

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Your Company_____

Co. Address (St. & No.)_____

City_____ **State**_____

COAL, ASH & BULK HANDLING

513—See page 132. Electric Vibrators: Their 3600 powerful vibrations per minute prevent "rat-holing" and plugging of coal bunkers in power generation station. Available in sizes to do the same job on small bins and hoppers — and chutes. Write for illustrated folder. Syntron Company.

514—See page 136. Car Shakeout: Consult Hewitt-Robins for fingertip control to your bulk materials handling. Controlled vibration leaves the car "broom clean" of hard-packed loads. Save time, money and labor. Write for full details. Hewitt-Robins, Inc.

515—See page 118. Hydraulic Ash-Handling System: Write today for your copy of the new Beaumont brochure: "Answers to Your Ash-Handling Questions". Contains expert recommendations on all types of ash-handling systems. Beaumont Birch Company.

516—See page 48. Bulk Materials Handling Systems: Stephens-Adamson engineers are at your service to solve your bulk materials handling problems quickly and economically. Write today. Stephens-Adamson Mfg. Co.

517—See page 149. Car Puller, Barge Movers: Electric, gasoline, diesel. Write for full information on power-driven capstans, gypsies, and single and double winches for all materials-handling applications. Silent Hoist & Crane Co.

CONTROLS, REGULATORS & INSTRUMENTS

518—See page 147. High Pressure Steam Gages: Send for your free illustrated Data Units and full information on Jerguson's complete line of steam gages. Available for all pressure requirements. Jerguson Gage & Valve Company.

519—See page 113. Accritem Regulator: Powers Accritem Regulators provide accurate low cost heat control for liquids or air. Calibrated dial provides easy temperature adjustment. Small size. Easy to install. Dependable, rugged construction. Write for Bulletin 316. The Powers Regulator Company.

520—See page 120. RANAREX Indicator and Recorder: For a quick, dependable check on CO_2 content of flue gases, use RANAREX. A sure check that is accurate to within 3/10 of 1% of CO_2. Uses no chemicals. Sturdily constructed and easily maintained. Write for free booklet. The Permutit Company.

521—See page 29. Electronic Analyzer: Weston Model 769 ultra high frequency electronic analyzer provides greater economy and convenience for practically all electronic measurements. A three-in-one instrument suited for AM, FM, television testing, and many applications in HF and VHF fields. Write for literature. Weston Electrical Instrument Corporation.

(Continued on page 126)

*** 2,800,000 C. F. M. . . . 120 AIR CONDITIONING SYSTEMS . . .** *showing 5 of the 324 Clarage Fans delivering conditioned air to manufacturing areas.*

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installs

CLARAGE HEAVY-DUTY FAN EQUIPMENT

Fine Pharmaceuticals! ...the making of over 700 different kinds has started in this great plant of the Upjohn Company, 10 minutes south of Kalamazoo.

Here much of the manufacturing... ***to maintain integrity of product*** ...is dependent upon air conditioning. 120 complete systems handling 2,800,000 c.f.m. are installed.

A multimillion dollar project... Engineers and Builders, The Austin Company, Cleveland.

Upjohn has had more than a quarter-century of experience with Clarage Equipment. It well may be that this was the deciding factor in selecting Clarage ***HEAVY-DUTY*** Fans for **every one** of the air conditioning systems operating in this new Upjohn plant.

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readers' guide to advertised products

(Continued from page 124)

522—See page 60. Magno-Therm Oxygen Recorder: If you are facing the problem of multiple fuel combustion, you will want a detailed copy of O_2 CO_2 Comparison Graph as well as Hays Bulletin 50-829—describing the Magno-Therm Oxygen Recorder. Write for this free information. The Hays Corporation.

523—See page 144. Electrical Trouble Shooter: Measures A. C. and D. C. voltages, current, resistances, etc., while appliance under test is in operation. Will test every type of motor from fractional H. P. to 2 H. P. Bakelite case 3⅛" x 5⅞" x 2¼". Complete with all test leads and instructions. Cost $13.90. Superior Electronic Co., Inc.

525—See page 142. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

526—See page 50. Pressure and Temperature Regulators: Write for Bulletin 350. Spence gives full data on Spence Regulators. They operate at low unit stress for long life, cut down maintenance cost. Spence Engineering Company, Inc.

527—See page 111. Level Indicators: Yarway now offers a complete system for constant, accurate check of boiler water and other liquid levels—at the boiler drum—on the instrument panel—throughout the plant. For complete information on Yarway Indicators ask for Bulletins WG-1823 and WG-1830. Yarnall-Waring Co.

528—See page 134. Analyzers: Send coupon for Bulletin 800-A on Gas Analysis. Data-packed pages have wide range of gas and analysis problems and their solutions. Charles Engelhard, Inc.

529—See page 152. Regulators and Thermometers: Bulletins 500 and 1000 give you full data on regulators and thermometers that will cut your processing cost to a new low. H. O. Trerice Co.

530—See page 142. Regulators: Valve-in-end construction gives you simple, compact design built for maximum performance. Stets Type G are setting new efficiency records daily. Write today for Bulletin 150. Stets Company.

531—See page 156. Measuring Devices: You can obtain complete information in brochures describing force measuring devices, push pull gauges, traction dynamometers and laboratory scales by checking the brochure you need on the special coupon to be found on page 156. John Chatillon & Sons.

532—See page 154. Temperature Regulators: Write for Stacon Bulletin 50-1000 for full details on extra sensitive, accurate, economical temperature regulators. Farris Stacon Corporation.

533—See page 151. Automatic Controls: Write for Catalog No. 700 for information and data on this complete line of automatic controls for heating, air conditioning, refrigeration and various industrial applications. Mercoid Corp.

DEHYDRATION EQUIPMENT

534—See page 133. Humidity Engineering: Write for full information on the Kathabar system that gives the giant Upjohn plant new concept of air conditioning with precise, dependable, low humidities. Write today. Surface Combustion Corporation, Kathabar Division.

DIESELS

535—See page 25. Supairthermal Engines: The outstanding engine of the Diesel field. Available in a complete range of 4-cycle types for fuel oil, Duafuel, or spark ignition gas operation. For all applications in sizes from 425 to 3200 B.H.P. Nordberg Mfg. Co.

536—See page 62. 4-Cycle Supercharged Diesels: Write for full details on the dependable, economical Diesel performance of Worthington's 4-cycle supercharged engines that will supply more kilowatt hours per gallon of fuel oil. Worthington Pump & Machinery Corp., Engine Division.

537—See page 67. Diesel and Dual Fuel Engines: Write for full information on CP engines—available in sizes from 120 to 1750 horsepower. Chicago Pneumatic Tool Company.

ELECTRICAL DISTRIBUTION

538—See pages 22, 23. I-T-E Switchgear: See pages 22, 23 for an interesting description of the progressive Research and Development Tower of S. C Johnson & Son. Protecting this power distribution system are an I-T-E coordinated outdoor substation. two I-T-E indoor unit substations, and an I-T-E distribution panelboard. Full details on I-T-E Switchgear available upon request. I-T-E Circuit Breaker Company.

539—See pages 8, 9. Fusetrons: A fuse to which is added a thermal cutout offers large time-lag and less electrical resistance. Fits standard fuse blocks and may be used throughout entire electric system. Send coupon for complete facts about Fusetron Dual-Element Fuses. Bussman Mfg. Co.

540—See page 127. Renewable Fuses: You are invited to write for latest catalog for more information about "Economy Delay" Renewable Fuses, which give safe protection where most overloads occur — in the 135 to 200% range. Economy Fuse and Mfg. Co.

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on pg. 123. Mail today—postage-free!

FILTERS, STRAINERS & PURIFIERS

541—See page 142. Self-Cleaning Strainers: New Bulletin No. 465 contains charts for computing steam pressure drops through strainers. Screens may be cleaned without removal from strainer body or shutting off the operating fluid. Leslie Co.

FUELS & FIRING EQUIPMENT

542—See page 49. Bell & Zoller Coals: Four more mines have been acquired to raise coal producing capacity to the highest level in history and enables Bell & Zoller to offer you an even more diversified selection of top-quality brand coals. Write for full information on qualities of famous brands now offered by Bell & Zoller Coal Company.

543—See page 34. Oil-Gas Burner Unit: Enco Oil and Gas Burner Units give uniform combustion quickly, surely over entire load range. Especially accurate where your steam demands vary sharply over short period. Write for free bulletin. The Engineer Company.

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(Continued on page 128)

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readers' guide to advertised products

(Continued from page 126)

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567—See page 44. Pumps: Now with the new "Warren-Quimby" combination you have two outstanding names in one giving you maximum service for your pump requirements. Write for Bulletin S-204. Warren Steam Pump Company, Inc.

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(Continued on page 130)

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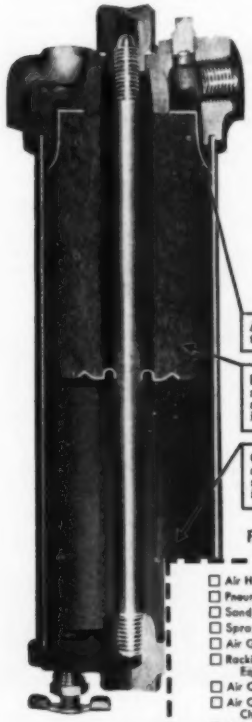

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A. Baffles deflect some moisture down outside cartridge.

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readers' guide to advertised products

(Continued from page 128)

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574—See page 148. Wilson 3-Way Service Team: Write for bulletins with complete information on Wilson tube cleaners and expanders. Wilson-Dunton safety bolt eliminates human element. Easy to install, reduces fire hazard, cuts costs. Write today. Thomas C. Wilson, Inc.

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575—See page 155. Steam Traps: Catalog 250 gives full details of Nicholson traps. For other advanced Nicholson features send for Bulletin 450. Write today. W. H. Nicholson & Co.

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599—See page 129. Cuno Flo-Klean Filter: Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in quick time. Write today or send coupon for full information. Cuno Engineering Corporation.

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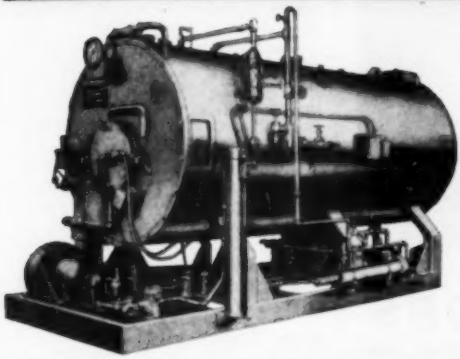

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Every gallon of Houghto-Solv keeps up to 4000 gallons of fuel oil free of damaging sludge. Permits you to burn all the fuel oil you buy. Saves you money every minute!

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Reckon the "bargain" in makeshift packings in terms of constant maintenance, frequent repacking — and equipment failure . . . you'll understand why so many select Palmetto for "greater economy in the long run."

Each strand of Palmetto Twist, for example, is built for 600 F superheated steam — thus gives bonus service at all lower temperatures.

Each strand is lubricant-impregnated for friction-free, self-lubricating performance. Will not harden. Will not bind valve stems or pump shafts.

Each strand is of high grade, high tensile Canadian white asbestos — quality that counts for better service, longer life all the way.

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Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

CENTRIFUGAL PUMPS

(Continued from page 96)

and, therefore, for single-stage pumps of average size and limited pressures, its effect is negligible. As the total head generated and pump size increases, means must be employed to eliminate this radial thrust, if possible, so as not to necessitate the use of extremely large diameter pump shafts.

One means used to combat the effects of radial thrust in volute type pumps is the twin-volute construction illustrated in Fig. 4. A twin-volute is, in effect, two half-capacity volutes, each taking the discharge from a 180 deg arc of the impeller. Of course, it must be considered that the twin-volute cannot eliminate the radial thrust of a single-stage pump entirely, since one of the volutes discharges into a straight discharge nozzle while the second discharges into the curved channel formed by the first volute.

Pump Classification

From a technical viewpoint, it could be questioned whether a twin-volute pump should be classified as a volute pump or as a two-ported diffuser. The twin-volute design has many potential advantages, particularly in the large capacity, medium and high-head, single-stage, vertical-pump applications, as the rib forming the second volute and separating it from the discharge waterway of the first volute adds to the strength of the casing.

The twin-volute is not as applicable in smaller-size pumps because of the difficulties in cleaning the casing passages in the foundry, and because of the increase in wall area and the resulting increase in frictional losses.

The twin-volute design does not, at present, seem suitable to axially-split, double-suction designs. The first objection arises from the fact that pumping applications requiring units of a large enough size to warrant this design, can generally utilize the more economical vertical-shaft, end-suction (bottom) type of construction.

Another objection is that the conventional design of a horizontal double-suction pump has a horizontal discharge and its casing is split in the horizontal plane, the split coming approximately 90 deg from the tongue of the volute. This makes it necessary to have part of both volutes split by the joint, thus offering a serious manufacturing problem in matching the waterways of the two halves.

NOTE—*More casing details will be covered in the next chapter, which will include additional structural information.*

NEW EQUIPMENT AND DEVELOPMENTS

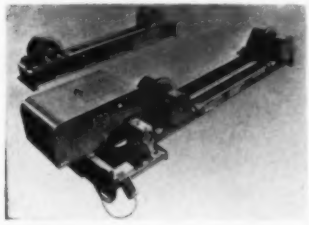
(Continued from page 21)

maintain all the previous exclusive advantages, such as concentric input and output hubs, which permit the use of the American torque-arm overload release. This unit is compact and features high-capacity, antifriction bearings for long, efficient service; heavy internal-ribbed housing assuring permanent gear and bearing alignment; forged, heat-treated alloy-steel helical gears providing ample capacity and quiet operation; exclusive oil-seal design and location above oil level to prevent oil leakage and ample housing area eliminating overheating.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

29—TURNING ROLL HAS VARIABLE SPEED DRIVE

Worthington Pump and Machinery Corporation's model 75PR turning roll is a direct result of research. With rubber-tired rollers, this turning roll has a capacity of 75 ton, the carrying capacity of which is distributed among three units — one power roll and two idler rolls, each having a 25 ton capacity. With steel-rollers, its turning capacity is increased to 150 ton. Here, the carrying capacity is distributed among six units — one power roll and



five idler rolls, each with a capacity of 25 ton. Motor-driven rolls are driven through an enclosed variable speed unit, having a range of speeds to meet individual job requirements. Means are provided to change the center-to-center distance of the rollers for handling work of various diameters. The rollers are mounted upon alloy steel dead shafts subjecting the shaft to bending stress only. The shaft is mounted in the roller upon tapered roller bearings with provisions for adjustment. The drive between the roller and worm gear box is through alloy steel spur gears enclosed with a guard to protect the gears and to keep them free from slag and dirt.

30—FLEXIBILITY FEATURES CHAIN CONVEYER

Southern Engineering Co., Inc. has just announced its Chain-Veyor that is a light capacity, power-driven, overhead chain conveyer engineered to provide dependable, trouble-free, long-time operation. The unit

Gives Giant Upjohn Plant "New Concept of Air Conditioning" with Precise, Dependable, Low Humidities

Penicillin! Streptomycin!...Kathabar equipment helps manufacture these wonder drugs, gives low humidities to speed production and maintain product quality. Many processes work better with the proper low humidity, accurately and precisely controlled.

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Another large pharmaceutical house during the last six years has purchased 24 Kathabar units. Kathabar helps produce America's drugs uniformly, inexpensively, consistently.

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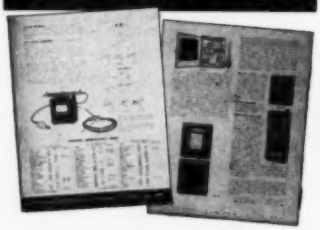

YOU WILL FIND a wealth of material on a wide range of gas analysis problems and their solutions in the new Engelhard 8-page illustrated bulletin. It explains how Engelhard equipment provides complete, sensitive, accurate analyses by the proven thermal conductivity method. The bulletin also contains a *valuable thermal conductivity table* that you will want to keep for handy reference. *Write for your free copy today. Ask for Bulletin 800A.*

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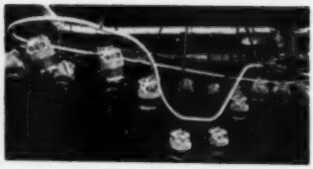
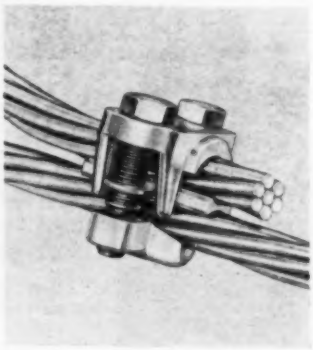


is extremely flexible and its short, radius curves and track sections are easily combined so that changes or additions can be made in a fraction of the time customarily required. It will handle loads up to 30 lb on each pendant spaced at six inch intervals, or 60 lb loads can be carried at 12 in. intervals when supported by two pendants fitted with cross bar attachment. The drive uses a special sprocket type unit to distribute chain stresses, affords a straight line pull and permits operation in either direction. Mounting is made at any 90 deg corner of the conveyer line.

31—CONNECTOR HAS LONG SPACER

Reliable Electric Co. announces production of a spacer type, two-belt connector. Two sizes, currently in production, provide a range of conductor sizes 2/0 to 2/0 in the smaller and 4/0 to 4/0 in the larger. An unusually long and generous die-formed, pure copper spacer affords full contact area and full conductivity. Pressures produced by the silicon bronze ma-



chine bolts and the cast aluminum bronze body and bridge normally require a spacer of sufficient length and conductivity to carry the full current load conductor to conductor. Connector design permits assembly to conductors in one place. Machine bolts have bronze retainers. The spacer is free floating and is secured to one of the bolts by a staked copper "U" wire. Manufacturer offers samples if requested on business letterhead.

32—FRACTIONAL HP MANUAL STARTER

The Square D Co. has announced a Class 2510 Type A fractional horsepower manual starter designed to control and protect single phase a-c and d-c motors of 1 hp and less. Both single and double-pole devices are available. The rugged double-break contact mechanism has quick make and break action and contact tips are of fine silver. The starter incorporates de-

pendable, trip-free overload protection, which gives a definite trip indication. Interchangeable overload relay units are accessible from the front. Line and load terminals are arranged for straight through wiring. Three types of enclosures are available as well as the open type starter general purpose (NEMA I), water and dust tight (NEMA IV and V) and explosion-resistant (NEMA VII and IX). Enclosure is die-cast aluminum and can be supplied with a pilot light for 115 and 230 v operation without increasing the overall dimensions.

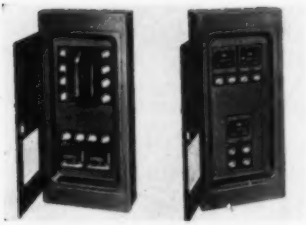
33—FLOORING MATERIAL WITH EMERY BASE

A mineral of the corundum group, second only to the diamond in hardness, has now been put to work to make floors last longer according to Walter Maguire Co. This mineral is emery and is used in what is know as an Emeri-Crete floor. It gives floors toughness and durability, is

highly resistant to the effects of oils, fats, sugar, organic wastes and most acids, withstands constant moisture and steam and is not affected by intense heat when mixed with heat-resistant cement, whether from molten metal, radiant heat of furnaces or contact with crucibles. Laboratory tests show that floors in which this emery is used as an aggregate will withstand crushing loads up to 14,500 psi without noticeable effect. Its high tensile strength of 1048 psi increases resistance to "tearing" caused by tractive pull of heavy loads.

34—LOW VOLTAGE ENTRANCE SERVICE

Square D Co. has announced two new types of 100 amp fusible service entrance equipment. This series type utilizes a fusible pullout disconnect, which controls all branch circuits. These devices are avail-



able with two 220 v, 30 or 60 amp pullout circuits in parallel, thus eliminating the need for a main disconnect. Flush and surface type covers are interchangeable. The interiors are mounted on a removable pan to facilitate mounting and wire pulling. These and other features such as solderless connectors, tangent knockouts and engineered gutters all combine for quick, easy installation.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

35—POWER TOOL KIT IS PORTABLE

A complete ¼ in. electric drill attachment combination, including a 4 in. portable saw attachment, for electrical service and maintenance men, is available from Kapner Hardware, Inc. Every device for a professional job of drilling in metal or wood, polishing, buffing, sanding, wood cutting or liquid

mixing is included in the outfit. The combination kit consists of: electric drill for 115 v a-c operation, portable electric saw attachment, 4 in. saw blade, lambs wool bonnet, 6 sanding disks, 7 assorted drills, steel arbor and attachments, cloth buffing wheel, grinding wheel, wire wheel brush, steel paint mixer, steel bench stand and portable steel carrying case.

36—MAGNETIC SWITCH FOR HEAVY LOADS

A line of magnetic switches, including magnetic contactors, automatic transfer

This
TRIPLE ACTING
NON-RETURN
VALVE

Automatically

✓ **Opens** when boiler pressure equals header pressure

✓ **Isolates** and prevents back steam flow into a defective or lower steaming boiler

✓ **Prevents** boiler steam flow when steam line or header is ruptured.

GOLDEN-ANDERSON

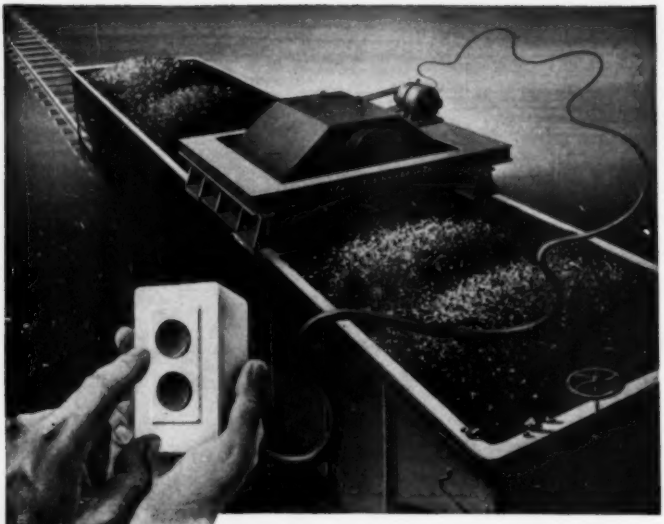
also makes this Single-Acting Non-Return Valve

which will automatically open to cut-in the boiler when its pressure equals the header pressure and automatically close to isolate the boiler when its pressure decreases.

Bulletins 5-1A and 5-2 contain complete technical data.

Golden Anderson Valve Specialty Company

2095 KEENAN BUILDING • PITTSBURGH 22, PA.



FINGERTIP ANSWER TO A 70-TON PROBLEM

One touch of a button . . . and a 70-ton hopper car empties itself in as little as 90 seconds!

One touch of a button . . . and even hard-packed loads come free, leaving the car "broom clean"!

For coal, stone, ore, grain—*whatever bulk material you must unload*—the Hewitt-Robins Car Shakeout is the *modern* answer. You save time, money and labor by reducing demurrage charges . . . by cutting unloading crews from as many as twelve to as few as two, even one. You end damage to cars, danger to workmen . . . make a tedious, expensive operation quick, simple, safe.

Over *four hundred million tons* of free-flowing bulk materials have been moved "down the hopper" by Hewitt-Robins Car Shakeouts.

Like so many other notable advances in bulk materials handling, the Car Shakeout is a Hewitt-Robins "first." The *controlled vibration* that makes it so efficient is an old story to us; we've put precisely controlled vibration to work in a long line of time-tested equipment for screening, sizing, feeding, conveying, grading, purifying, dewatering or otherwise processing everything from bits to boulders . . . from pumice to pyrites.

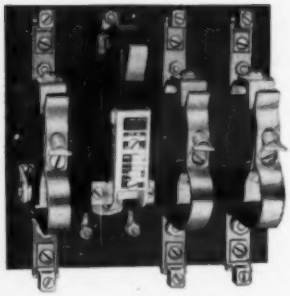
If you have a screening problem . . . *whatever it is* . . . why not make it ours?

HEWITT HR ROBINS

Executive Offices: 370 Lexington Avenue, New York 17, N. Y.

HEWITT RUBBER DIVISION: Belting, hose and other industrial rubber products
ROBINS CONVEYORS DIVISION: Conveying, screening, sizing, processing and dewatering machinery
ROBINS ENGINEERS DIVISION: Designing and engineering of materials handling systems

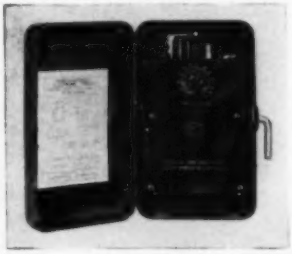
Hewitt-Robins is participating in the management and financing of Kentucky Synthetic Rubber Corporation



switches and automatic reversing switches is now offered by the Lumenite Electronic Co. These Lumenite magnetic switches embody all the newest protective devices so that they are able to handle the rated capacities with a side margin of safety and complete dependability. The reversing and transfer switches are fitted with both electrical and mechanical controls so that it is impossible to confuse the circuits. Heavy copper spring, with full floating armature, assures instant contact with rolling, wiping action on both make and break. Contacts are copper to copper or silver to silver.

37—SHORT INTERVAL WELDING TIMER

Electronic timer Type 30CR3, designed by Photoswitch Inc. meets the requirements for accurately controlled short interval timing. It has a timing range of from 3 to 120 cycles and fulfills the specifications of NEMA class 1A non-synchronous timers. In addition to its many general purpose timing applications, Type 30CR3 is recommended for spot welders and is applicable to manual, air or motor operated welding



equipment requiring either beat or non-beat operation. The timing adjustment is located on a panel inside the housing thus providing a tamper-proof setting. It may be used with either a 115 or 230 v a-c supply. By simple selection of terminals the timer will provide "beat" or "non-beat" operation. The terminal panel is provided with a bakelite dead-front eliminating the danger of an operator contacting the terminals when setting a timing interval.

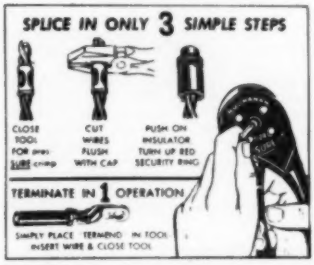
38—OILER FOR LP GAS AND GASOLINE ENGINES

Universal Lubricating Systems, Inc. announces a redesigned and improved universal top oiler for gasoline and LP gas engines. Known as No. 3000, Model B, it features the following improvements: (1)

a bracket, made of steel and designed for greater strength, (2) container lid design allows the oil feeding assembly to be quickly and easily pulled out for filling the container with top oil or to clean the feeding tube when necessary, (3) intake manifold fitting provides a better method of introducing top oil into the manifold, (4) a change in the adjusting screw to permit oil feed from any required minimum to any desired maximum, and (5) a loop in the transparent tubing to hold a reservoir of oil and thereby allow an immediate surge of oil to the engine when starting. It is a metering device, which distributes top oil evenly to all cylinders in a gasoline engine and overcomes the uncertainty of top cylinder lubricating when top oil is introduced in the fuel tank.

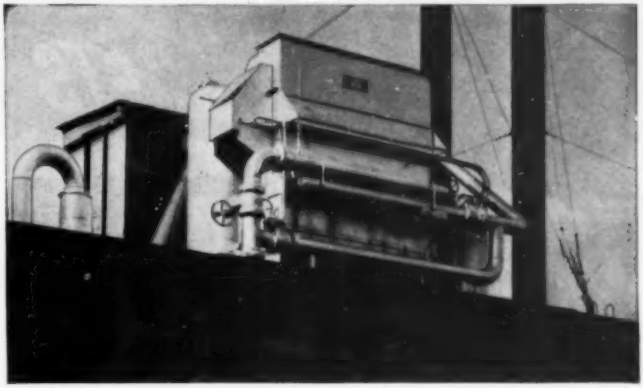
39—PIGTAIL WIRE SPLICING CAPS

Splice caps for pigtail splicing of electrical wires are now available from Buchanan Electrical Products Corp. in an improved open-end construction that considerably facilitates their installation and inspection. This product insures that wire insulation is always flush for maximum circuit protection. Wires are always inserted to the full depth of the cap for maximum point efficiency.


SPLICE IN ONLY 3 SIMPLE STEPS
CLOSE TOOL FOR good WIRE crimp
CUT WIRES FLUSH WITH CAP
PUSH ON INSULATOR TURN UP RED SECURITY RING
TERMINATE IN 1 OPERATION
SIMPLY PLACE TERMINAL IN TOOL INSERT WIRE & CLOSE TOOL

Only two sizes are required for all most frequently used combinations of two or more wires ranging all the way from two No. 18 to three No. 8. Quickly applied snap-on insulators of fixed insulating value eliminate necessity for taping of joints and insure against insulation breakdown in service. A hand operated pressure tool installs both sizes of splice caps and features an exclusive four-way crimping action that insures per-

Direct saving of cooling water expense returns to you the cost of a Niagara Aero After Cooler in less than two years.



How to Get Drier Compressed Air:

It prevents many troubles and saves much expense

● NIAGARA AERO AFTER COOLER cools compressed air or gas below the temperature of the surrounding atmosphere. Therefore you get no further condensation in your lines. You save much in repairs to pneumatic tools and equipment; you save much interruption to production; you save water damage in paint spraying, in air cleaning, in any process where compressed air comes in contact with your materials or parts in manufacturing (sand blasting, for example).

Niagara Aero After Cooler uses evaporative cooling, saving 95% of your cooling water consumption. This saving quickly returns the cost of the equipment to the owner or makes extra cooling water available for other processes.

The Niagara Aero After Cooler produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. Other Niagara equipment provides bone-dry air for processes requiring it.

If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

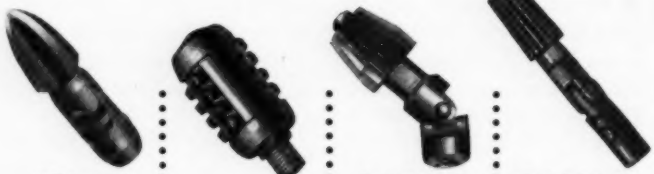
Dept. IP, 405 Lexington Ave. **New York 17, N. Y.**

Experienced District Engineers in all Principal Cities

for cleaning those MIGHTY IMPORTANT small tubes"

AIRETOOL'S line-up of midget cleaners provides you with just the right tools for safe, quick, thorough scale removal from condenser, heat exchanger and all other small tubes.

Exponding blade type head with #29 motor



Drill head and Universal Joint

Brush type head

Single Unit head with cone cutter

Single Unit head Universal Joint

These cleaning heads can be used with either a flexible drive or universal joint for removing scale or other deposits from straight or bent tubes. Tube sizes range from 5/8" to 2" I.D. Midget motors are powerful and are air driven.

By using them regularly, you reduce down-time and add to the life and usefulness of your valuable equipment. To learn the full story, write The AIRETOOL Mfg. Co., 318 S. Center St., Springfield, Ohio.

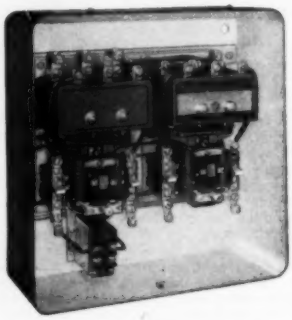
BRANCH OFFICES:
New York
Philadelphia
Chicago
Houston
Tulsa
Baton Rouge

THERE'S AN AIRETOOL TUBE CLEANER AND TUBE EXPANDER FOR EVERY TYPE OF TUBULAR CONSTRUCTION

manent connections of maximum electrical and mechanical efficiency. It is equally effective on solid or stranded or on combinations of solid and standard wires.

40—INCREMENT A-C STARTER AVAILABLE

Allen-Bradley Co. announces a new a-c part winding starter for use with motors that employ two separate parallel windings, star or delta, to obtain increment starting. The unit consists of two across-the-line starters and a pneumatic timing mechanism mounted below one starter and operated



by the starter's solenoid plunger. Pressing the "start" button immediately closes the first starter, which energizes one of two parallel windings. Meanwhile, the timer is in operation and after a few seconds energizes the second starter. With both starters closed, full line current is supplied to the motor through both windings, each using 50 per cent of the total current drawn.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

41—TUBING SUITED FOR HYDRAULIC JOBS

A line of tubing especially suited for use as hydraulic cylinders, shock absorbers and other applications where pressure is to be converted into mechanical movement, has been announced by Tube Reducing Corp. Available in bores ranging from about 1½ to 6 in. depending on wall thickness, the new tubing is free of scratches, pits and other irregularities, which are ironed out when the tube is sized by pressure exerted between two dies and a mandrel. Surfaces of the new cylinder-finish tubing are smooth

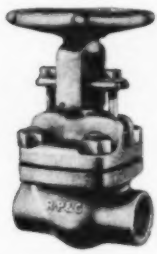
and do not require machining for use with leather or other soft packing such as is used for cup pistons. For use with metal piston rings, the tubing requires no boring but only a light honing operation.

42—TWO STAGE PUMP DEVELOPS HIGH HEAD

A completely redesigned line of two-stage pumps, designated as Type DMD, is announced by Economy Pumps, Inc., Div. of Hamilton-Thomas Corp. The pumps have been improved with regard to compactness, pumping efficiency and mechanical ruggedness. Type DMD pumps are made in sizes from 2 to 10 in. discharge; capacities up to 4000 gpm and heads to 750 ft. The new models are recommended for services such as high head water works, building water supply, hydraulic elevators, oil refineries, mines, chemical plants, boiler feeding and many other allied uses. It has a horizantally split casing with inter-connecting passage between the two opposed impellers. The impellers are the non-overloading type, hydraulically and dynamically balanced at the factory. The large diameter shaft is carried on heavy duty cartridge-type dust proof ball bearings. For thrust, an angular contact duplex bearing is used. Radial load is supported by a double row ball bearing.

43—HIGH PRESSURE FORGED STEEL VALVE

A forged steel gate valve was designed by R-P&C Valve Div., American Chain & Cable Co., Inc., particularly for high pressure. Among the features are a bolted bonnet, which insures maximum service life and low cost maintenance, tongue and groove joint with soft iron gasket to assure tightness under varying service conditions and extremely hard wedge facing that minimizes seizing, galling and abrasive wear.



Stainless steel gland bolts and nuts prevent freezing or corrosion while the two piece gland and follower applies uniform pressure on packing—will not bind on stem. Available in sizes of ¼, ⅜, ½, ¾, 1, 1¼, 1½, and 2 in.

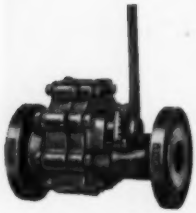
44—SAMPLING OR VENTING VALVE

Oil-Rite Corp. announces a double duty valve, which can be used for sampling oils and other liquids or for venting air into tanks. Designed principally for use on oil-immersed electrical equipment such as transformers and regulators, the valve has many applications on a variety of industrial equipment requiring periodic sampling of liquids or venting air. When used for sampling it

• DIRECT HEATING OF VAPORS
• DIRECT HEATING OF LIQUIDS
If your plant requires
• DOWTHERM INDIRECT HEATING
• STEAM GENERATORS
• STEAM SUPERHEATERS
• WASTE HEAT BOILERS
. . . place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.
Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.
Every day more than 750, oil and gas fired, Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.
PETRO-CHEM DEVELOPMENT CO., INC.
120 East 41st Street, New York 17, N. Y.
Representatives:
Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh
Faville-Levally, Chicago • Lester Oberholz, Calif.

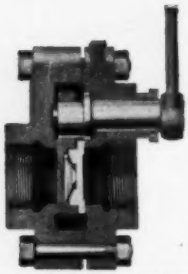
EVERLASTING VALVES

mean "Everlasting" Protection on these duties

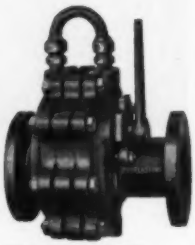


GENERAL SERVICE

Wherever frequent use and quick operation is required for any liquid or gas at pressures



up to 300 psi. These valves have outside stuffing box and gland.



STEAM JACKETED

Assure continued free flow of any material which congeals at ordinary temperatures.

FIRE PROTECTION

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.

BOILER BLOW-OFF

Quick-opening, also hand-wheel operated, Angle and "Y" types meeting ASME Code requirements for pressures up to 600 psi.

BOILER WATER COLUMN

With indicator and locking device. Meets ASME Code requirements.

EVERLASTING FEATURES

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

Quick-Action . . . opened or closed with less than a quarter turn of the operating lever.

Straight-Through Flow . . . the disc cannot become loose and accidentally check the flow.

Drop-Tight Seal . . . constant contract of disc and seat at all times prevents dirt or scale from getting between.

Self Regrinding . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

No Wedge Action . . . all parts move between parallel faces.

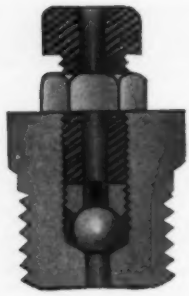
Write for bulletin describing EVERLASTING VALVES in detail.

EVERLASTING VALVE COMPANY, 49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

Trade-Mark "EVERLASTING" REG. U. S. PAT. OFF.

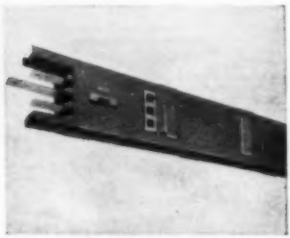
for everlasting protection



is inserted close to the bottom of the oil or other liquid containing tank, permitting samples to be drawn off conveniently. Inserted at the top of a tank, the same valve can be used for venting air. The brass valve has a steel ball inside its body that is pressed against the seat of an orifice by a conveniently located and easily operated threaded hex bolt. When the bolt is backed up, the steel ball is lifted from this seat, permitting liquid to flow through a cross slot and on through the center hole of the belt where it is collected for sampling.

45—BUS DUCT COMES IN FOUR TYPES

Four standardized types of bus duct for a variety of industrial power distribution system applications are available from Westinghouse Electric Corp. Included are plug-in duct for branch runs, providing power take-off outlets every twelve inches; weatherproof feeder duct for outside runs (transformers to switchgear); low-impedance duct for long feeder runs, or where minimum voltage drop is important; and weatherproof



low-impedance duct for runs between transformers and switchgear, where the duct must withstand high short-circuit stresses. All types except weatherproof feature channel construction of the top, sides and bottom for maximum rigidity. Bus bar joints are silver plated to assure good electrical contact. Alignment of the duct is made by means of cantilever clamp hangers. The structure is bonderized for corrosion resistance and assurance of better paint adhesion.

46—NICKEL PROCESS CUTS CORROSION

Strategic metals such as nickel can go hundreds of times as far and still give the same protection against the ravages of corrosion with the use of Lectro-Clad pipe and fittings now made available by the Bart Manufacturing Corp. The process is patented and consists of depositing a predetermined thickness of nickel on the in-

terior and/or exterior of pipe and fittings from 1 1/2 to 20 in. IPS. Only 0.006 in. nickel is necessary to protect against most corrosive action; however, in extreme cases up to 0.015 in. or more can be applied. The bond is such that the nickel actually becomes an integral part of the steel. The lining has proven to be pore-free and can withstand severe tests such as heating, bending, welding and reducing without any effect to the bond or corrosive resistance of the nickel.

47—CONDUIT HANGERS EASILY INSTALLED

Low-cost conduit hangers for installing single runs of electrical conduit have just been announced by the Kindorf Co. This simple B-Series is a supplement to the same manufacturers line of supports for multiple-run conduit installations. A single run of conduit can quickly be hung from structural steel I-beams, channels, angles or columns—or from concrete inserts or wood-frame members. These devices are interchangeable and re-usable. Whenever re-location of light power-driven machinery is necessary conduit runs can be taken down and the hangers re-used in the same or different combinations. Because the small number of interchangeable devices meet all ordinary needs of single-run conduit installation, only a minor investment is required.

48—CAPACITORS FOR WIDE TEMPERATURE RANGE

A line of 100 v d-c capacitors, with double the capacitance designed into the same capacitor space, has been announced by the General Electric Transformer and Allied Product Div. that meet all the requirements of "F" characteristics of JAN-C-25 for 100 v d-c units. For applications where an expected life of 1000 hr is satisfactory the rating can be increased to 150 v and temperatures to 40 C. Test results show that there is negligible change in capacitance from -40 to 105 C, and the units give full life expectancy at temperatures as low as -55 C. They will not introduce noise into the system and will pass signal voltages approaching zero.

THE spring IS THE THING

AJAX

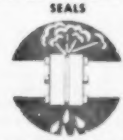
SPIRAL WOUND GASKETS

KNIFE-EDGES BITE INTO FLANGE SURFACES

PRESSURE-SEALED

THEY BREATHE WITH VARYING PRESSURES AND TEMPERATURES

LIGHTER BOLT LOADS. SAFER SEALS



NO DRIP—NO SQUIRT—NO HISS

The Gaskets with resilience "built in," to make positive, lasting seals. Made for all types of pipe flanges, pressure vessels, and for boiler manholes, handholes, tube caps, water walls, economizers and other boiler accessories. A trial will end your gasket troubles.

OTHER STANDARD INDUSTRIAL GASKETS

In addition, we offer a complete line of corrugated metal and metal-asbestos gaskets; solid metal, serrated and profile types. Sold universally through Industrial Distributors. Ask your Supply House or write

UNITED STATES GASKET COMPANY

670 N. 10th Street Camden 1, N. J.

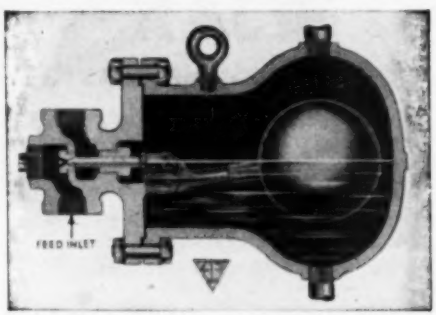
Leading Fabricators of "TEFLON" for the Chemical, Process and Electronic Industries.

"LIQUIDS WORTH STORING ARE WORTH MEASURING" WITH A

LIQUIDOMETER *Tank Gauge*

WRITE FOR COMPLETE DETAILS

THE **LIQUIDOMETER** CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.



you get *plus-value* with STETS Type G Regulators

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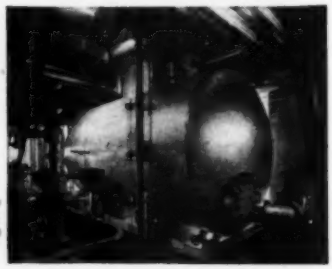

Photo at right Belco High Pressure Steam Deaerator. Capacity 300,000 lbs. per hour.

NEW BULLETINS

(Continued from page 32)

POWER TRANSMISSION

253—Roller Bearings. Engineers and specifiers of industrial roller bearings and mounted units will be interested in 56-page catalog 51. Fully illustrates and describes full line of roller bearing units plus unmounted roller bearings. Design features such as concave rollers operating between matched convex races, and the advantages of this design are fully discussed. Of interest are larger models of bearing units with standard shaft sizes now available up to 5-in. dia. Also contains complete engineering and load rating data and illustrates many product applications. Shafer Bearing Corp.

254—Chain Drives. Unless a chain is properly installed and operated . . . given periodical inspection, lubrication and adjustment it will not give 100% satisfaction. How best to accomplish this is pointed out in bulletin 51-7, entitled "Installation, Operation and Maintenance of Chain Drives and Conveyers". Illustrations show correct and incorrect ways of solving chain installation, operation and maintenance problems. Chain Belt Co.

255—Drives. Catalog C72-51, in addition to describing HY-VO power transmission drives, includes basic discussion of operating principles behind chain drives; highlights of design principles incorporated in HY-VO drives; description of what the drive will do in high-speed heavy-duty power transmission field; capacities, speed ranges and service factors for selecting drives; installation and lubrication procedures. Morse Chain Co.

256—Roller Chains & Sprockets. Catalog RS-50 covers full line of roller chains and sprockets from stock. Provides complete specifications and engineering reference tables on American standard roller chains, sprockets and attachments. Dimensional data, strengths and weights are also supplied on allied products, such as block chain, cable chain and flexible couplings. Whitney Chain Co.

257—Speed Reducers. Bulletin A602B, 12 pages, illustrates and describes line of single reduction speed reducers. Lists advantages and gives construction data. Selection chart shows how to choose proper sizes for specific needs. Bore dimensions and bushing data are given in tabular form. Table of recommended V-Belt drives included. Dodge Mfg. Co.

PUMPS AND ACCESSORIES

258—Reciprocating Pump. Recently developed 3 in. stroke, direct flow pump is described in 6-page bulletin 64A. Presents features of design, construction, dimension drawings and performance data. Recommended applications

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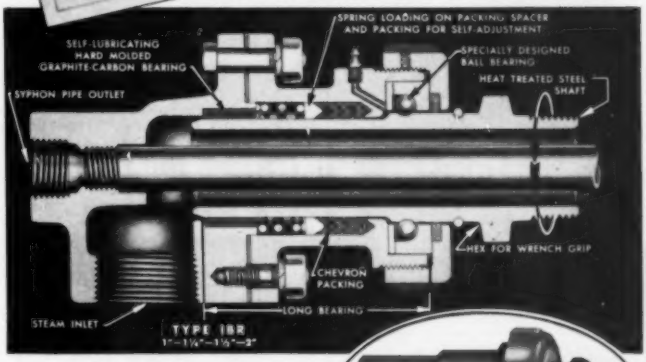
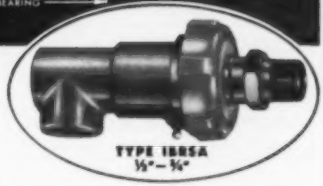
BARCO

REVOLVING JOINT



Syphon Style—TYPE IBR. Built for 450°F., steam service to 150 psi, and up to 500 RPM. Hydraulic service to 200 psi, 750 RPM. Higher pressure and speeds under certain conditions.

Single Flow Style—TYPE IBRSA. Similar to Type IBR. Sizes 1" and larger have 2-piece flange connected body.



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HERE is the new *improved* Type IBR Barco Revolving Joint! Precision-built and field-tested, it has met with enthusiastic approval by machinery designers and operating engineers, alike. Here are some of the reasons why:

LOW TORQUE CUTS POWER COSTS! Wide spacing between bearings holds bearing loads to a low limit and maintains close alignment. Specially designed ball bearing carries both radial and end thrust. Inherent low torque is little affected by pressure, speed, or temperature. Up to 50% power savings.

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Handsome round cornered molded bakelite case 3½" x 5¼" x 2¼". Complete with all test leads and instructions.

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include chemical handling, hydraulic systems and oil field service. The Aldrich Pump Co.

259—Packings & Gaskets. The 95 most popular packings and gaskets in the R/M line are illustrated and described in 32-page bulletin P100C. Furnishes complete description of construction, service recommendations and size information on each item. Features charts showing specific recommendations for the wide variety of applications. Raybestos-Manhattan, Inc., Packing Div.

260—Boiler Feed Pumps. Bulletin 1525 contains complete description and cross section drawing of high pressure barrel-type boiler feed pump. Features listed include: Available for pressures to 3000 psi; ability to be thrown on the line quickly; automatic balance; double volutes; individually bolted diaphragms; and, pressure lubricated axially split radial bearings. De Laval Steam Turbine Co.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

261—Plastic Packings. Plastic packings are featured in a 4-page bulletin that illustrates and completely describes non-jacketed plastic packings. Applications include reciprocating, centrifugal and rotary equipment in power plants, paper mills, steel mills, etc. Raybestos-Manhattan, Inc., Packing Div.

262—Centrifugal Pumps. Self priming centrifugal pumps ranging in capacities from 4000 gph to 90,000 gph are described in 20-page illustrated bulletin 51-27. Discusses design features which include easy and inexpensive replacement of wearing parts as well as the impeller shaft seal which is never subjected to pumping pressure. Specifications included. Chain Belt Co.

263—Pump Valves. Bulletin W-404-B4 covers Worthington's Rollo valves for viscous liquids and liquids with solids. Diagrams point out design advantages and photographs show the four component parts. Case histories bear out their claim for long wear and freeness from operating difficulties. Worthington Pump & Machinery Corp.

TOOLS AND SPECIALTIES

264—Hydraulic Puller. Bulletin 97A, 8 pages, on hydraulic puller (capacity 17½ tons — weight 10 lb) completely describes how the tool with its "Center Hole" feature adapts itself to all OTC pulling systems now in use. Illustrates methods for installing and removing cylinder sleeves, shafts, gears, wheels and many other usages. Owatonna Tool Co.

265—Locknuts. Two types of locknuts and their advantages are described in 4-page illustrated folder TL63. One

How to select and use fuels and fuel combustion equipment

Here is a handbook on every phase of fuels and combustion apparatus that not only gives fuel technicians and engineers an indispensable desk tool but also provides rule-of-thumb guidance for practical operators. In it you will find helpful data on a wide variety of combustion problems — from determining the fuel that will work most effectively on a particular job, or selecting the most efficient machine for a specific purpose — to computing heat balances, or devising a means of storing a gaseous fuel.

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HERE is a valuable handbook covering every aspect of commercial fuels, indeed worthy of the term "fact-packed"—a handbook to fall in step with Marks' **Mechanical Engineers' Handbook**, Perry's **Chemical Engineers' Handbook** and other standard handbooks, as the authoritative reference in its field—giving both engineers and plant men the best on-the-job guidance and data that can be compressed into one comprehensive volume.

This book discusses the properties, characteristics, and uses of all solid, liquid, and gaseous fuels — the basic way in which these fuels are utilized in combustion processes—and the operation and maintenance of combustion equipment.

Besides presenting data on factors connected with fuel combustion, such as heat balances, smoke prevention, and draft and chimney requirements, it takes up the selection and purchase of fuels — the preparation of fuels for use—fuel handling and storing—and the transfer and generation of heat. Individual chapters run the gamut from the general characteristics of solid fuels, to petroleum and petroleum derivatives . . . from treating and drying coal, to handling and storing liquid and gaseous fuels . . . from fundamentals of furnace design, to boiler measurements and tests.

Look up such topics as:

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- analyses of propane
- heat values of lignite char
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- boiler ratings of British thermal units
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type has a tough nylon plug insert in one of the hex faces on the nut midway between top and bottom as its locking element, while the other contains a treated hexagonal fibre washer as the locking medium. Both are cold forged. Specifications are listed in tabular form according to sizes and finishes. Townsend Co.

266—Thread Inserts. Bulletin 650R covers design data on helical-wire thread inserts and the use of these inserts in the protection and repair of tapped holes. Detail drawings and text explain how these inserts are used. Tabular data give basic insert lengths, recommended drill sizes, etc. Heli-Coil Corp.

267—Masonry Saw Blades. Practical illustrated instructions on how to figure blade costs in masonry cutting before starting operations are contained in 24-page booklet. Tells how to know the correct blade to use on each different material in addition to how blades perform their cutting operation. Contains other factual information in "how to" form. Eveready BrikSaw Co.

VALVES, PIPING AND FITTINGS

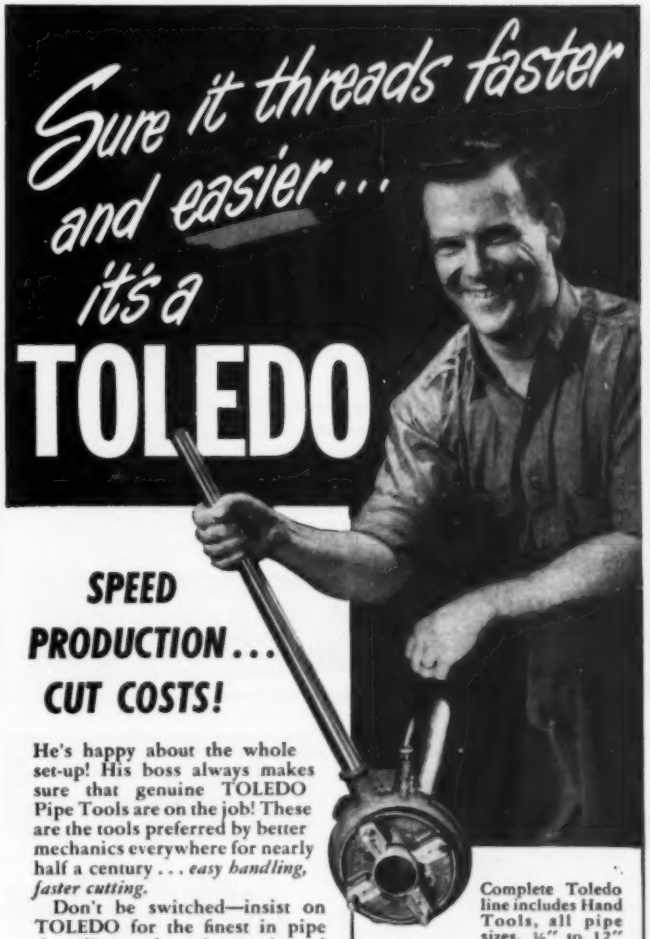
268—Condenser Tube Manual. Compact 120-page ready reference manual tells the whole story of tubes used for condensers, heat exchangers, evaporators and general piping. Deals with corrosion-resistant alloys and gives the results of research and study of corrosion. Contains a wealth of information and helpful suggestions on application, installation and maintenance of condenser tubes. Bridgeport Brass Co.

269—Relief Valves. Protect equipment against dangerous pressure increases. Bulletin 711 gives full information on line of forged steel relief valves of seat and ball disk type. Edward Valves, Inc.

270—Stainless Steel Valves. Full line of stainless steel valves, fittings and accessories are covered in 48-page catalog. Gate, globe, angle, needle, Y, and check valves are some of the units illustrated and described. Diagrams and tables show design features, sizes and specifications. Table on corrosion resistance of stainless alloys is included as is materials reference chart which gives suggested applications for the various alloys. The Cooper Alloy Foundry Co.

271—Gate Valve. Construction features of forged steel gate valve are listed in 4-page bulletin DH273. Tables show working pressures and dimensions. Cutaway drawing portrays design advantages of the small, general purpose steel valve. R-P & C Valve Div., American Chain & Cable Co., Inc.

272—Variable-Support Pipe Hangers. Catalog 501 gives 12 pages of factual information on variable-support spring hangers. Line embodies 48 load-travel combinations in a range from 1½ to 6 in. Full description of design features is contained along with convenient tables and diagrams showing dimensions, specifications and rated load. Of particular interest is a load-deflection



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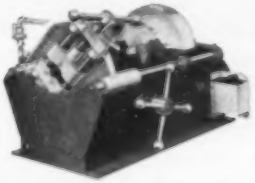
Complete Toledo line includes Hand Tools, all pipe sizes, ⅛" to 12" and ¼" to 1" bolts. Power pipe machines, up to 2" and 4" capacity. (Above)—Toledo No. 1R Threader, 1" to 2" pipe.



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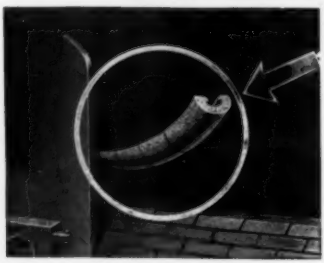

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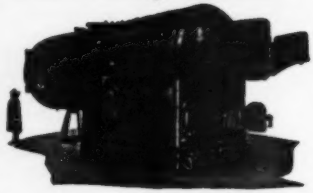

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Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

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chart which enables easy selection of units best suited for particular needs. Bergen Genspring Corp.

273—**Stainless Welding Fittings.** Lightweight welding fittings for use with light gage pipe in industrial applications are described in 16-page catalog 105. Advantages and physical characteristics are given as are full instructions on how fittings are assembled. Photos, diagrams and tables show the types and sizes available. Includes table giving friction of water in pipes. Tri-Clover Machine Co.

274—**Anti-Corrosion Tape.** How to stop service pipe corrosion with tape is explained in 4-page brochure E-SPF. Tells how a single tape can effectively combat the corrosive action of moisture, alkalies, oils, fats, and fungi on underground service pipes. Includes pictures showing application techniques, and lists chemical, physical and electrical properties of the tape. Minnesota Mining & Manufacturing Co.

275—**Piping Pointers.** Helpful hints on the application and maintenance of piping equipment are contained in new edition of Crane's Piping Pointers manual. Covers the fundamentals of sound piping practices in non-technical language. Discusses various types of valve designs and how each should be used. Over half the 36-page booklet is devoted to "how to" features that are fully illustrated for easy understanding. Selection guide included. Crane Co.

For more information use one of the convenient reply cards on page 123. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

276—**Swing Check Valve.** Full instructions on installation, operation and adjustment of cushioned swing check valves are contained in 4-page bulletin W-1. Gives general dimensions along with specifications and list of materials. Golden-Anderson Valve Specialty Co.

277—**Power Operated Valves.** Colorful 44-page bulletin V-214, packed with piping, wiring, mounting, and installation data for pneumatic, hydraulic, and electric operated lubricated plug valves claims to be the first complete compilation of such data. Included are typical piping diagrams, arrangements for both side and top mounted motor controls, closing speeds, wiring data, and installation photos. According to the manual, use of power controls reduces operating costs, permits flow control from remote points, and makes timed-cycle operations easy. Rockwell Mfg. Co.

278—**Nozzles, Welding Necks & Flanges.** Anyone having a specific interest in pressure vessel work should avail themselves of this 72-page catalog 501. Describes a line of nozzles, welding necks and large diameter flanges. Contains a wealth of information pertaining to these products in addition to data covering TEMA Standards. Numerous tables, diagrams and charts are includ-

ed along with installation and application photographs. Taylor Forge & Pipe Works.

279—Check Valves. Durable, compact, accessible, low friction—that's what 4-page bulletin WH100 says about flanged silent check valve. Cutaway views portray design and construction features, while on-the-job photos show the valves actually installed and operating. Chart for drilling bolt holes included. Available in all regular pipe sizes from 1 to 20 in., for all pressures up to 6000 lb and for any temperature. The Williams Gauge Co.

280—Corrosion Proof Linings. General bulletin MCC-1, 8 pages, describes complete line of chemical construction materials. Entire series of protective coatings including plastic as well as natural and synthetic rubber linings, cements, brick and tile sheathings is listed in tabular form. Contains a great deal of general information and refers to specific bulletins for additional details. Photos and diagrams show various applications. Atlas Mineral Products Co.

HEATING, VENTILATING AND AIR CONDITIONING

281—Air Cleaner. Precipitron electronic air cleaner is presented in 8-page bulletin SA6691. Describes the Precipitron and explains how it operates; why it cleans air efficiently; where it can be used; how it is constructed; and, how to select unit for a given application. Westinghouse Electric Corp., Sturtevant Div.

282—"Packaged" Precipitron. Westinghouse now offers electronic air cleaners in packaged units, according to 8-page bulletin DB93-820. Although not shipped in one piece, all parts are matched for sure fit and every necessary item is included. Booklet tells all the advantages and gives typical industrial applications. Construction features and typical specifications along with capacity and dimension table round out the two-color booklet. Westinghouse Electric Corp. Sturtevant Div.

283—Air Conditioning Equipment. Carefully selected list of equipment needed to do a job of air conditioning has been condensed into 16-page catalog SA-6692. Cooling, heating, dehumidifying, cleaning, filtering, circulating; or ventilating; or air handling are all covered. Westinghouse Electric Corp., Sturtevant Div.

284—Freon Coolers. Freon or ammonia coolers of the dry expansion type are the subject of 12-page bulletin 101. Should be a valuable aid to those concerned with air conditioning, process, industrial and commercial refrigeration applications. Contains such valuable information as charts and tables showing cooling surface required for capacities from 2 to 232 tons of refrigeration at water flow rates from 15 to 575 gpm and for various baffle spacings in single and two-circuit designs. Also includes a log mean temperature table, cooler selection data, dimensions, pressure drops and typical piping arrangements. Patterson-Kelley Co.

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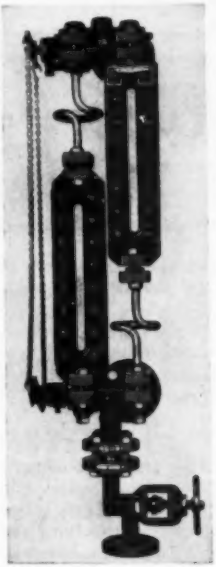
Rugged, Space-Saving Design, Expansion Coils, Other Special Features Insure Best High Temperature Performance



YOU'LL find that this Jerguson Model 618HP Gage will give you the kind of job you want in your power plant . . . rugged, efficient, uninterrupted, long life service.

You are assured of top performance because Jerguson has built the Model 618HP to meet the most exacting requirements of high temperature work. Both chamber and cover are rugged forged steel. At either end are specially designed Jerguson *expansion coils*. These coils, by absorbing excessive expansion and contraction, insure proper functioning of the gage under highest temperature conditions, and are another special Jerguson feature that assures you of highest accuracy and dependability. Valves on the Model 618 are for flanged or socket welding connections with outside screw and yoke.

Jerguson High Pressure Steam Gages are available in all pressures to suit your needs. The Model 618HP meets exacting Navy requirements and is now in use on scores of U. S. battleships and destroyers. It will pay you to investigate.

Jerguson offers a complete line of high pressure steam gages, inclined gages, and remote reading gages for power plant use. Write today, without obligation, for free illustrated DATA UNIT on the type of gage in which you are interested.

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MISCELLANEOUS

285—Automatic Oilers. Bulletin 4900 was designed to aid in selecting the proper visible, automatic oiler for constant level, gravity, wick, underfeed, multiple and large capacity gravity feed applications. Contains valuable suggestions on how to eliminate waste and dangers of "trust-to-luck" oiling. Installation photos show actual applications. The broadside opens to 17 x 22 making it useful as a wall chart. Trico Fuse Mfg. Co.

286—Corrosion Control Coatings. Synthetic rubber based corrosion control coatings are the subject of 8-page brochure. Coatings for machinery, damp walls, cement floors and stucco masonry are discussed. Gives application data and recommendations. Casey & Case Coating Co.

287—Industrial Lighting. Aimed at the industrial plant operator, 16-page booklet B4727 stresses three ways that better lighting can work for him. Illustrations of various luminaires of each type of lighting are presented along with wattage and lumen output ratings. Special lighting for special areas is illustrated. Westinghouse Electric Corp.

288—Corrosion Protection. Six-page folder explains pigmented organic corrosion resistant coatings and their application by brush, spray or dip. Pictures of various products and equipment protected with the coating are shown, together with list of typical applications. Also offers experimental service, in which test panels or actual parts are coated and returned to the inquirer for testing. Permolite, Inc.

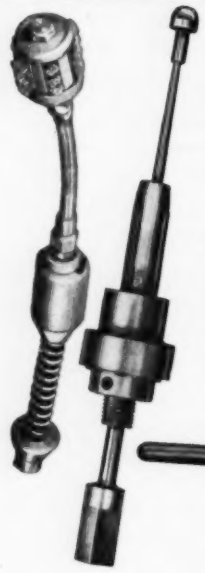
289—Fire Extinguisher Guide. General folder covers complete line of portable and special purpose fire extinguishers available to industry. Handy chart provides an easy-to-use guide for selecting the right extinguisher for every type of fire hazard in industry. Stop-Fire, Inc.

290—Custom Products. Catalog shows facilities for producing custom products to your specifications. Large tanks, boilers, heat exchangers, stacks, duct work, structural assemblies, hoppers, and pressure vessels are some of the items pictured and discussed. Hapman-Dutton Co.

291—Anti-Corrosive Paint. Technical bulletin sheet 025 itemizes and explains the six main advantages of ready-mixed, all-purpose aluminum paint. Recommends its use inside or outside—wherever corrosive conditions are met. Prufcoat Laboratories, Inc.

292—Immersion Heaters. "100 Ways to Apply Electric Heat" gives complete details showing how to use immersion heaters in industrial applications. Drawings and photographs illustrate installations. Offers engineering service for assistance and recommendations. Edwin L. Wiegand Co.

WILSON
3-WAY SERVICE TEAM



WILSON TUBE CLEANERS make short work of the toughest deposits. They provide faster, more thorough, more economical tube cleaning which decreases maintenance costs and increases production time. Driven by air, water, steam or electricity, Wilson Tube Cleaners are available for straight or curved, ferrous or non-ferrous tubes from 3/8" to the largest ever cleaned.

WILSON TUBE EXPANDERS are precision-made. Their smooth efficient rolling action insures firm seating of the tube . . . provides perfectly rolled joints . . . reduces time-wasting re-rolling and re-inspection. There is a Wilson Tube Expander for every conceivable need, from 3/16" I.D. to 12" I.D. for use in power plants, refineries, boilers, heat exchangers, etc.

WILSON-DUNTON SAFETY BOLT eliminates the "human element" . . . makes it impossible to pull a hot industrial or marine oil burner with the pressure on. It is easy to install, reduces fire hazard, cuts liabilities. First cost is only cost. This long-needed safety device is available for most popular makes of oil burners.

WRITE FOR BULLETINS

THOMAS C. WILSON, INC., 21-11 44TH AVE., LONG ISLAND CITY 1, N.Y. • CABLE "TUBECLEAN" NEW YORK

WILSON

TW-788

WILSON TUBE CLEANERS • WILSON TUBE EXPANDERS

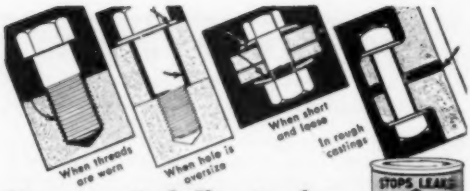
IN
NEW YORK
The PLYMOUTH
offers you
EVERYTHING
in the center of
EVERYTHING

Free radio in every spacious room, Television available to every guest. Air-Conditioned Bar and Restaurant. Garage. Accommodations for 1000

Write for selection of popular
VISITOURS
Packaged all expense-included thrill trips with meals, shows and all the sights of the wonder city.

Leslie L. Paul
Managing Director

AAA
HOTEL Plymouth
West 49th STREET bet. B'WAY and RADIO CITY



How to Solidly Anchor LOOSE BOLTS

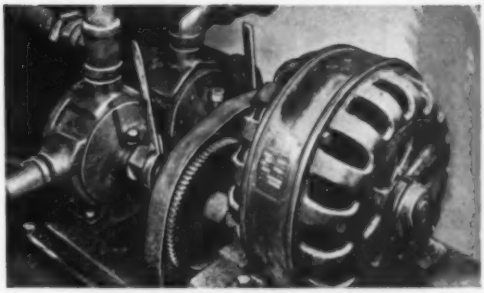
Bolts with worn threads—undersize bolts in oversize holes—bolts passing through thin walls—bolts holding ill-fitting cast flanges—all can be tightened firmly with quick-setting Smooth-On No. 1 Iron Cement. Use it, too, to lock nuts tight, and to cover and protect countersunk bolt heads in metal or wood. These repairs stay tight because Smooth-On expands slightly as it hardens. Buy Smooth-On No. 1 in 7 oz., 1 lb., 5 lb., 20 lb., or 100 lb. size and keep it handy. If your supply house hasn't Smooth-On, write us.

FREE REPAIR HANDBOOK

40 pages filled with time-saving, money-saving repairs on plant, shop and home equipment made with No. 1 and other Smooth-On Cements. Drop us a line for YOUR free copy.

SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

Do it with **SMOOTH-ON**
THE IRON REPAIR CEMENT OF MANY USES



A 1915 MODEL AT WORK

There's Something of This Old Work-Horse in Every VIKING PUMP

This old-timer probably does not look like Viking pumps you are now using, but something of this old work-horse has always been built into every Viking pump. The ingredients of that "something" are: ONE, the operating principle (most copied of all rotary pump designs) and, TWO, the old-time skill and workmanship of generation after generation of expert craftsmen.

When you specify Viking, you are sure of a good name, a good product and good pumping service. Send for free bulletin 51SG.

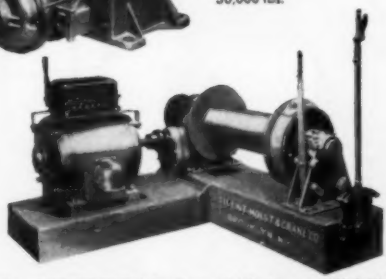
See Our Catalog in SWEET'S

Viking PUMP COMPANY
Cedar Falls, Iowa

CAR PULLERS, BARGE MOVERS
ELECTRIC, GASOLINE, DIESEL

Let *Silent Hoist* Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.

CAPSTAN 6 Sizes: Draw Bar Pull Capacities	DRUM WINCH 4 Sizes:
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of ***KRANE KAR*** *Swing-Boom Mobile Cranes,* ***LIFT-O-KRANE*** *Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.*

SILENT HOIST & CRANE CO.
856 63rd STREET, BROOKLYN 20, N. Y.

PLASTIC FLOOR PATCH
....Sets Instantly!

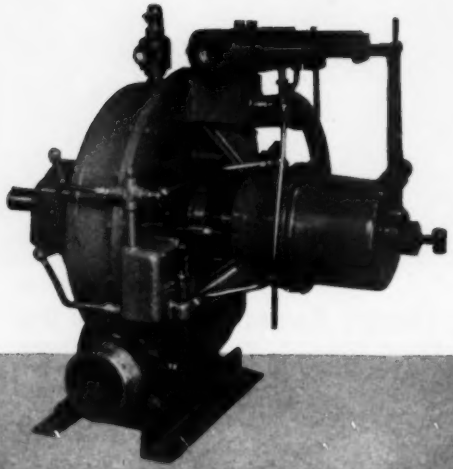
Use durable INSTANT-USE . . . a tough plastic material which you simply shovel into hole — tamp — and run traffic over immediately. Tough INSTANT-USE is ideal for repairing cracks and breaks due to relocating machines . . . or for complete overlays. NOTE: Plasticizer makes INSTANT-USE easy to scoop out of container . . . easy to level, to tamp, to use! *There's a Flexrock material for every floor condition — oil, acid, wet, dry! Tell us your problem!*

Mail Coupon for Free Trial Offer and Hand Book of Building Maintenance

FLEXROCK COMPANY
2405 Filbert St.,
Phila. 4, Pa.
Offices in Principal Cities

Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN, and Hand Book of Building Maintenance—no obligation.

Name .....
Company .....
Address .....



Wing

AUXILIARY

TURBINES

WING TURBINES are especially economical for driving pumps, fans, compressors, etc., in plants using steam in process operations. The turbines act as reducing valves on boiler steam pressure, the power which drives the turbines, therefore, being practically free.

Wing Turbines for over half-a-century have been noted for their rugged construction, trouble-free operation and long life.

Maximum BHp 150. Maximum Steam Temperature 750 F. Maximum Pressure 600 lbs. Back Pressure to 50 lbs. Speeds to 4000 rpm.

L. J. Wing Mfg. Co.

Linden, N. J.

Offices in principal cities

"SPOT" NEWS OF INDUSTRY

(Continued from page 114)

B-H No. 1 Insulating Cement and every B-H Blanket which leaves the company's four plants at Trenton, N. J., Huntington, Ind., Kalamazoo, Mich., and Temple, Texas.

The company is authorized to use a certification label on the insulating products for application at power plants, refineries, institutions and manufacturing concerns.

The nationwide certification program, sponsored by the Industrial Mineral Wool Institute, of which Baldwin-Hill is a member, is based on the standards and requirements published by the U. S. Department of Commerce on high and low temperature mineral wool insulations and the products certified conform to the requirements of Commercial Standard CS117-49 and CS105-48 as issued by the National Bureau of Standards.

Storage Battery Cases Sealed by Electric Heating Unit Built into the Conveyer Belt

A recently-installed radiant heater oven is said to solve the problem of properly flowing the asphalt sealing compound on the cells of storage batteries.

The new installation involves 4 Chromalox RAD heaters, type RAD-311, 1100 watt, 230 volt, placed over the conveyer. The heaters replaced a combination of infrared lamps and a gas flame which burned the top of the batteries and often failed to produce the proper knit of asphalt compound and case.

The heaters are arranged in groups of two with built-in hinge joint. They are controlled by rheostat and interlocked with the conveyer so that the heater circuit opens whenever the conveyer stops. One rheostat controls each group of two providing maximum flexibility of temperature in each end of the oven. The rheostat also provides flexibility of control for several different sizes of storage batteries which pass under the heater at a distance of 1½ to 2 in. The conveyer travels at a speed of approximately 5 ft per minute and the tunnel length is 6 ft.

Besides obtaining the proper knitting of asphalt and case with no detrimental effects on the battery, the new installation is claimed to produce fewer rejects, permit higher efficiency by operating in high ambient temperatures, provide greatly simplified control, and reduce the fire hazard through the elimination of gas. Total cost of the installation was less than any equivalent heating means.

Battery cases on conveyer enter oven where radiant heaters will seal asphalt compound to case without stopping carrier

WORLD'S LARGEST REFRIGERATION INSTALLATION

Fourteen Carrier centrifugal compressors, each rated at 1500 hp., provide refrigeration for wind tunnels at NACA's Lewis Flight Propulsion Laboratory in Cleveland. With this equipment, which provides refrigeration equivalent to 30 million lb. of ice every 24 hr., extremely low temperatures are reached to simulate high altitude conditions. This is enough refrigeration to provide every home in Chicago with a 40 lb. chunk of ice every day

Vitrified Clay Pipe To Be Used To Carry Off Heavy Acid Fumes

Vitrified clay pipe, which is immune to the destructive qualities of acids and gases, will be used in the construction of a channel and stack for carrying heavy acid fumes from the Delco Battery Plant, of Muncie, Indiana.

About 400 feet of 36-inch vitrified sewer pipe will conduct sulfuric acid fumes to a 24-inch vitrified sewer pipe stack. A pull fan will be mounted midway up the stack. Engineering will be handled by R. Haubursin, plant engineer, and his staff.

Electric Utilities Consuming Record Coal Tonnage, Mining Congress Told

America's electric utilities, which consumed nearly 92 million tons of coal in 1950, probably will consume a record 108 million tons this year, according to L. R. Ludwig, assistant to the vice president in charge of industrial products for the Westinghouse Electric Corporation.

Mr. Ludwig spoke in Cleveland at a luncheon meeting of some 500 delegates to the American Mining Congress Coal Show. He pointed out that these figures place electric utilities almost on a par with the steel industry as a market for the nation's coal.

"The electric utility industry consumed almost 92 million tons of coal in 1950, 9.4 per cent more than in 1949 but still about 8 per cent below the peak year's consumption of 99½ million tons in 1948," he said. "Other recently published figures indicate consumption may approach 108 million tons in 1951."

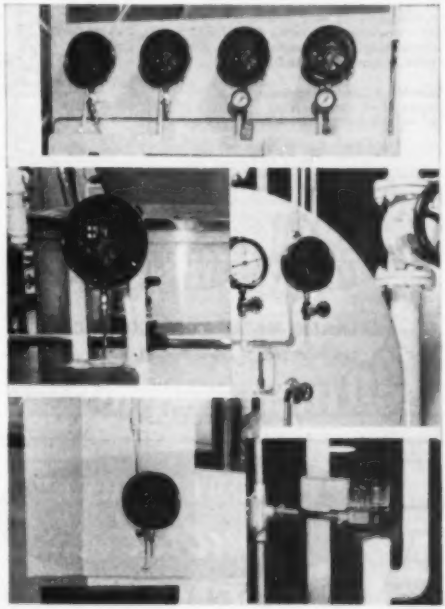
Establishment of Corona Laboratories Is Announced by National Bureau of Standards

Establishment of a new National Bureau of Standards laboratory center at Corona, Calif. to be devoted to various phases of electronic research, development, and engineering was announced by Dr. E. U. Condon, director of the Bureau. It will be primarily concerned with technical problems of importance to the Department of Defense. Dr. R. D. Huntoon, formerly Chief of the NBS Atomic and Radiation Physics Div., has been named associate director to head the new laboratory.

About 22 buildings, formerly used by the navy, will be renovated to accommodate NBS research activities being transferred from Washington.

MERCOID
AUTOMATIC CONTROLS

FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.



Above photos show few of a number of Mercoid Control applications in The Upjohn Plant-one of America's outstanding essential industries

MERCOID CONTROLS ARE EQUIPPED WITH MERCURY SWITCHES, THEREBY INSURING GREATER SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE

SIMPLE TO ADJUST FOR THE SPECIFIED OPERATING RANGE

WRITE FOR CATALOG 700--- PLEASE MENTION THIS PUBLICATION

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

FLEXIBLE METAL HOSE

Tortured

FOR YOUR PROTECTION

"TEST HOSE TO FOUR TIMES SPECIFICATIONS" is standard procedure with every length of Atlantic flexible metal hose.

17 rigorous torture tests for flexibility, bursting pressure and uniformity reveal any material or fabricating fault. That's why Atlantic flexible metal hose is Job Tested & Guaranteed to Do Its Job!

Seamless & Interlocking Hose.
Bronze, steel, stainless steel.
⅛"-36" I.D. with proper fittings.

Write for Catalog 500

See Our Catalog in Sweet's File for Product Designers

ATLANTIC METAL HOSE CO., INC.
124 West 64th St., New York 23, N. Y.

AIR FORCE routs the enemy!

Don't let Dirt, Dust, and Grit shorten the life of your machinery and equipment. Blast the destroyers out of every crack and crevice with a CLEMENTS-CADILLAC blower-suction cleaning tool. Good maintenance pays!

Eligible for DO-97 Rating. See NPA Regulation 24.

SAVE
TIME • MONEY
PREVENT DAMAGE TO MACHINERY WITH THE . . .

Made in 5 models with attachments for every cleaning job.

CLEMENTS CADILLAC
PORTABLE COMBINATION BLOWER-SUCTION CLEANER

CLEMENTS MFG. CO.
6628 S. NARRAGANSETT AVE. CHICAGO 38, ILL.

ASK YOUR MILL SUPPLY DEALER OR WRITE US FOR DATA

"TROUBLE FREE" Control . . .

TRERICE
SELF-OPERATING REGULATORS and DIAL THERMOMETERS
Constant Temperature Regulation for

• HOT WATER TANKS • PASTEURIZERS • PRE-HEATERS
• STORAGE ROOMS • VATS • PLATING TANKS
• COOKERS • FEED WATER HEATERS • WATER JACKETS

Cut your processing costs to a new low with the Trerice Self-Operating Regulator. This dependable, experience-proven regulator provides trouble-free control . . . eliminates over-heating! Saves you steam, fuel and labor while affording improved "quality control" over your product. Your low, initial investment in the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer, will be repaid many times over during their first year of service.

WRITE DEPT. A-13 FOR BULLETINS 500 AND 1000

INDUSTRIAL THERMOMETERS · RECORDING THERMOMETERS · AIR OPERATED CONTROLLERS · ENGRAVED STEM THERMOMETERS · STEAM TRAPS · PRESSURE GAUGES

H. O. TRERICE CO. SINCE 1923

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IN CANADA: 170 Ferry Street • Windsor, Ontario

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New York • Toledo • Toronto, Canada

Handiest Location in PITTSBURGH

Hotel Pittsburgher
PITTSBURGH, PA.

Right in the heart of town

Make the PITTSBURGHER your stopping place on every motor trip. Located right in the heart of town . . . easily reached from all major highways. Enjoy the finest in modern facilities, too . . . 400 rooms each with free radio, bath and circulating ice water. Garage service.

a Knott Hotel

JOSEPH F. DUDDY, MANAGER

CLASSIFIED ADVERTISING

FOR SALE

FOR SALE

1—Skinner Steam Engine Generator Set consisting of the following equipment:
a—15" x 16" Automatic Horizontal Skinner Steam Engine, No. 7556.
b—Direct connected Western Electric 125 KW A.C. Generator, type R, 26 CE, 3 phase, 60 cycle, 240 volt, 301 amp., 257 rpm 243344 complete with exciter control panel.

ALSO

1—No. 5A Automatic "Iron Fireman" serial No. CC 5711 equipped with three strand V-belt drive, less motor with blower.
1—No. 90 "Iron Fireman Junior" stoker serial No. 13097 complete, less motor.

PORCELAIN PRODUCTS, INC.
422 West Sandusky Street
Findlay, Ohio

USED EQUIPMENT

Mixed Pressure Kerr Turbine and Condenser with Allis-Chalmers 600 amp. 240 volt generator and exciter. Chuse Steam Engine with Western Electric 40 KW 240 volt generator and exciter. 450 H.P. Murray-Corliss Tandem Compound Steam Engine. 4" x 8" Triplex Gould Feed Water Pump. 21000 gal. capacity Permutit Water Softener. Cochrane Feed Water Heater and relief valve. 2-Laclede Chain Grate Stokers. Used Valves 3½ to 10". Phone collect GArfield 1322, Saxony Mills, St. Louis, Mo.

FOR SALE

2 H.R.T. Boilers, 100 horse power each, size 16 ft. long, each having 54 flues 4 inch diameter and the boilers are 5 ft. in diameter. This will include preheater and electric boiler return system, very good shape. 1 New Combustion Engineering Steam Driven Stoker, 7 inch retort Type E-MP, stoker class 7, size 6' 0" furnace 7' 0" long and 6' 0" wide, never used and in original crates.

WAUSAU BREWING COMPANY
Wausau, Wisconsin

FLASH
Flour Mill Machinery
&
Miscellaneous Equipment
Electric Motors 1/20 HP to 600 HP
Misc. Electric Equipment
Write—Wire—Call—R. E. Miller
INTERNATIONAL MILLING CO.
Mpls. 1, Minn.

WANTED

Wanted—Transformer totalling 800 KVA 2400 volt primary—440 volt secondary. Write us giving full detailed information and price.

EMPIRE BOX CORPORATION
Stroudsburg, Penna.

PROFESSIONAL SERVICES

LP-GAS ENGINEERING & CONTRACTING

INDUSTRIAL STAND-BY PLANTS OUR SPECIALTY

More than 70 Peacock Designed Plants prove . . .
"There's No Substitute For Experience"

Write For Full Information

PAUL E. PEACOCK, JR.
Box 268, Westfield, N. J. Westfield 2-6258

BUSINESS OPPORTUNITIES

If you are planning on expanding, or increasing your production in other areas because of the crisis, write or call Mayor G. A. Gilbert or J. G. Ihnat, City Promotional Manager, for a copy of "A Preliminary Industrial Survey of Watertown, South Dakota."

AVAILABLE REPRINTS

SPECIAL REPRINT

of the report on

INDUSTRIAL WASTE TREATMENT

To fill requests we've received for additional copies of the special report on "Industrial Waste Treatment", June 1951 issue, it has been necessary for us to re-order reprinted copies. These copies are still being offered to our readers ***free of charge in quantities of 1 to 5.*** However, it is necessary for us to make a small charge, sufficient only to defray printing costs, for larger quantities. These prices are: 6 to 25 copies—25¢ each; 26 to 50 copies—20¢ each; more than 50 copies—15¢ each. Order the copies you need directly from Reader Service Department, INDUSTRY AND POWER, 420 Main Street, St. Joseph, Michigan.

We also have a few copies of the following article reprints which are available to you free of charge:

"Boiler Houses Are Not Necessary Evils", February, 1950.

"Correct Plans Consider Future Expansion Too", December, 1950.

"Filters . . . What They Are, How and Why They Are Applied", February, 1951.

"Grievances Can Be Avoided", April, 1950.

"Harbor Plant Pioneers in Pneumatic Build-Up Refractory", December, 1950.

"How to Select the Correct Steam Trap", January, 1950.

"How To Select Corrugated Expansion Joints", June, 1950.

"Know Your Fuses", March, 1951.

"Low Cost Auxiliary Power From Turbine Drives", April, 1950.

"Monsanto Builds Ideal Process Steam Plant at Everett, Mass.", June, 1950.

"Proper Water Tower Means Water Conservation", March and April, 1951.

"Qualifications of an Industrial Supervisor", June, 1949.

"Select Correct Batteries for Starting Diesels", Nov., 1949.

"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.

"Simplify Determinations of Pipeline Pressure Losses", November, 1949.

"Steam, Air, and Power for 3 New Ford Assembly Plants", May, 1949.

"Streamlined Steam Plant Insulation", May, 1951.

"Supervisor's Personal Check-Up Chart", November, 1949.

"Synchronous Motors Do Two Jobs at One Time", February, 1950.

"Television . . . The Eyes of Industrial Control", Dec., 1950.

"Trigonometric Calculations — I and II", April, 1951.

"Water Treatment for Air Conditioning Systems", May, June and July, 1949.

"Willmar, Minn., Increases Capacity of Municipal Power and Heating Plant", April, 1951.

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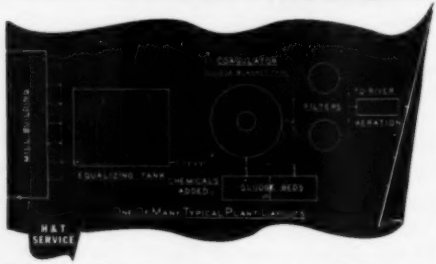
HOW HUNGERFORD & TERRY TREATS INDUSTRIAL WASTE WATER PROBLEMS



1. Survey of flow rates, quantity of water, available equipment, space, pipe sizes, and other information.
2. Analysis of representative waste water samples, to determine the most efficient and economical treatment. A complete report on treatment and treatment cost is submitted.
3. Build model waste water treating unit from our laboratory findings. A quantity of waste water is passed through the model in the presence of plant representatives. Samples are analyzed to show treatment process.
4. A formal proposal is prepared and submitted with a schematic drawing to show operating arrangement and complete guarantees of EFFLUENT capacity and quality.
5. Work in close co-operation with all national, state and local government authorities.

Write For More Information

HUNGERFORD & TERRY, INC.
Clayton 1, New Jersey

SELF -CONTAINED -CONTROLLED -SUFFICIENT -RELIANT

Stacon Temperature Regulator*

The patented Farris Stacon Temperature Regulator is easily the most independent regulator available today. It's unique. It stands alone. It's trustworthy. It needs no watching. It's perfect for the man who wants no cause for worry . . . who wants to relax in the sure knowledge that his temperatures are constant.

Here's why Stacon stands alone in the field. It has no packing glands to leak or bind . . . the stem moves freely. The liquid in the bulb flashes to vapor in the power bellows, assuring hairtrigger response to move the disc. It operates with unbelievable accuracy—to within plus or minus 1 degree—and it operates with that accuracy under *all* conditions. Stacon provides air-operated accuracy at low, self-operated cost.

Get the details on the one truly outstanding temperature regulator—Stacon. Send for Bulletin 50-1000 to get all the details.

*Patented and Patents Pending

Farris Stacon Corporation
533 COMMERCIAL AVE. PALISADES PARK, N. J.

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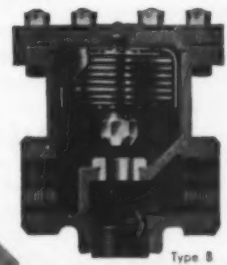

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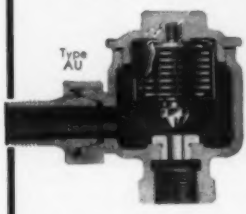

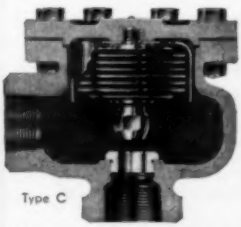

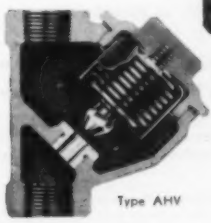

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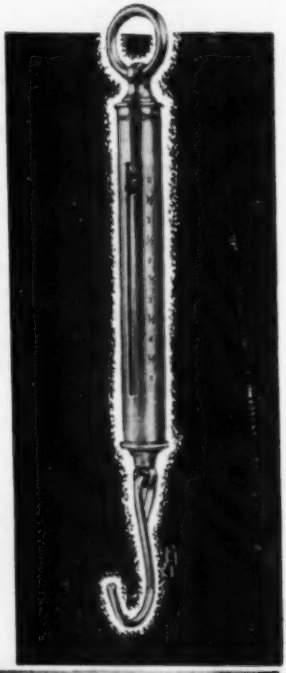

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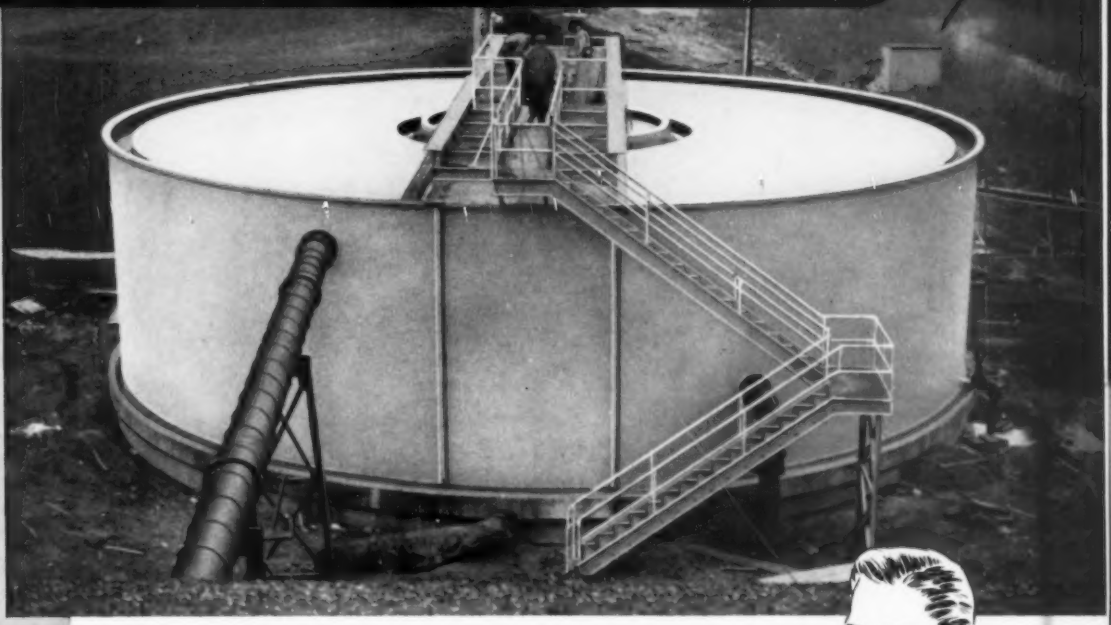

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